Evaluating Conservation in Zoos:

A New Zealand perspective

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Abstract of a thesis submitted in partial fulfilment of the
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Contemporary zoos are considered to perform three central roles of conservation, education, and entertainment. While the topic of zoos' contribution to conservation has been widely debated in the literature, research evaluating conservation efforts in zoos is rare. Similarly, there is very little literature on the specific contribution made by zoos to the conservation of indigenous species. As a consequence, the purpose of this research was to evaluate the contribution that New Zealand zoos make to the conservation of indigenous species.

A combination of desk-based and field-based research was conducted for this study. Based on an extensive literature review, six criteria (Education; Research; Captive breeding; In-situ conservation; Collaborations; and Associations, accreditation, and awards) were selected for the evaluation. The evaluation which incorporated thirty-two zoos indicated that New Zealand zoos, as a whole, are contributing to the conservation of indigenous species.

Thirteen semi-structured interviews were conducted with three conservation practitioners from the Department of Conservation, and with a total of ten zoo practitioners from Auckland Zoo, Orana Wildlife Park, and Willowbank Wildlife Reserve. These interviews served to add depth to the evaluation by examining the practitioners' perspectives on conservation in zoos. Several themes arose from the interviews that had not been apparent in the desk-based stage of the research. The most notable of these was that the conservation and zoo practitioners alike considered conservation advocacy to be the most important role of a zoo. Based on the research findings, a series of recommendations were made for zoos to improve their contribution to the conservation of New Zealand indigenous species.

Keywords: Zoo; Evaluation; Conservation; New Zealand; Indigenous species; Education; Ex-situ conservation; Advocacy.

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Chapter 1
Introduction

1.1 History and function of zoos

The first recorded zoo was the palace menagerie of Queen Hatshepsut of Egypt, which dates back to the 15th Century BC (Alexander, 1992 as cited in Mason, 2000). Pre-modern zoos historically existed in multiple cultures around the world, including in ancient Egypt, ancient China, medieval Europe, and pre-Columbian America (Bostock, 1993). Regardless of their location, authors agree that the purpose of these early zoos was to demonstrate prestige and power, and to entertain (Holst & Dickie, 2007; Sterling, Lee, & Wood, 2007; Carr & Cohen, 2011).

The first modern zoo was built in Vienna in 1752, followed by Paris in 1793 (Jamieson, 1985; Mason, 2000; Lee, 2005; Griggs, 2006). However, the first zoo that closely resembled contemporary zoos was opened in London to Fellows of the Zoological Society of London in 1828 (Hancocks, 1995; Zoological Society of London, 2012). The purpose of this zoo was for scientific study and education (Sterling, Lee, & Wood, 2007; Carr & Cohen, 2011). London Zoo opened to the public for an entrance fee in 1847, which supported the zoo's collection and research (Ballantyne, Packer, Hughes, & Dierking, 2007). Visitor numbers began to decline in zoos from the late 1960s, due to pressure from anti-zoo groups, increasing animal welfare concerns, and environmental consciousness among the public (Holst & Dickie, 2007; Frost, 2011). According to Holst and Dickie (2007), conservation became part of zoos' purpose as the zoos responded to this pressure.

Today there are over 10,000 zoos worldwide, approximately 1000 of which are associated with the World Association of Zoos and Aquariums (WAZA). According to Mason (2000), most of these zoos are in North America, Europe, and Australasia, although zoos are increasingly being established in developing countries (ZooNet, 1998 as cited in Mason, 2000). Although there is no figure available of the total zoo visitations worldwide, WAZA's World Zoo and Aquarium Conservation Strategy (2005) stated that 600 million people visit their 1000 associated zoos and aquaria each year. Today, zoos are considered to have three primary roles of conservation, education, and entertainment (Ryan & Saward, 2004; Frost, 2011; Mason, 2011), and are considered to have become a mass tourism and leisure experience (Carr & Cohen, 2011).

1.2 Zoos and conservation

The topic of conservation in zoos has been widely debated worldwide, and the general consensus of the literature is that zoos at least have the potential to contribute to conservation. The conservation of species outside their natural environment (also known as ex-situ conservation) is considered by the Convention on Biological Diversity 1992 to be complementary to the conservation of species in their natural environment (in-situ conservation) (United Nations, 1992). This again implies that zoos have a place in conservation. In addition to contributing to conservation through ex-situ means, zoos have the potential to engage in in-situ conservation and in visitor education advocating for conservation (Balmford, Leader-Williams, & Green, 1995). However, while conservation in zoos has been discussed on an international scale, there is a lack of literature specific to New Zealand and to New Zealand indigenous species.

There is a need for research investigating zoo-based conservation efforts. In particular, evaluation tools to assess zoo-based conservation activities and their impacts on conservation have been rare (West & Dickie, 2007; Zimmerman & Wilkinson, 2007). Furthermore, Zimmerman and Wilkinson (2007) added that knowing what conservation activities are taking place in zoos is an essential first step. In essence, this research aims to evaluate the extent to which zoos in New Zealand contribute to the conservation of indigenous species in New Zealand. The remainder of this chapter sets out the context for the research aims and objectives, defines some key terms and provides an outline of the structure of the thesis.

1.3 History and function of New Zealand zoos

The first zoo established in New Zealand was Wellington Zoo in 1906 (Mason, 2008). It was followed by Auckland Zoo, which was a private menagerie, but was sold to the Auckland Council and opened to the public at its current location in 1922 (Auckland Zoo, 2012). The purpose of these zoos was primarily entertainment. This was indicated by Auckland Zoo's decision in 1956 to begin chimpanzee tea parties due to the perception that the visitors wanted to be further entertained (Auckland Zoo, 2012). However, it was also in the 1950s that the first captive breeding programme for an indigenous species was started (Butler, 1992). The programme was for takahe (*Porphyrio hochstetteri*), and was operated at Mt Bruce by Geoffrey Orbell, who rediscovered the species, and local Elwyn Welch, who trained bantam hens to foster the takahe chicks (Pukaha Mt Bruce, 2012).

Contemporary New Zealand zoos exhibit a range of indigenous species, some of which are listed as critically endangered, endangered, or vulnerable on the International Union for

Conservation of Nature (IUCN) Red List (IUCN, 2011). The indigenous species exhibited in zoos include birds, lizards, amphibians, and invertebrates. A range of these species are bred in captivity, and some captive-bred individuals from zoos have been released back into the wild (Richardson, 2001; New Zealand Conservation Management Group, 2004; Tringham, 2007).

The regional zoo association is the Zoo and Aquarium Association (ZAA) for zoos in Australasia. While there are no total visitation figures for New Zealand zoos alone, ZAA (2012) stated that over 17 million people visit member zoos and aquariums in New Zealand and Australia each year. Visitor attendance numbers provided to the International Zoo Yearbook (2011) showed that in 2010, ten New Zealand zoos had a collective attendance of 1,525,000. In addition, over 60% of international tourists to New Zealand and Australia visit ZAA zoos and aquariums (ZAA, 2012).

1.4 Conservation in New Zealand

Due to New Zealand's remote location, there is a high degree of endemism among New Zealand indigenous species (Mumaw, 1992; Garland & Butler, 1994). Discounting two species of bats, New Zealand's indigenous species evolved in the absence of terrestrial mammals (Garland & Butler, 1994). Since human settlement, predation from introduced mammals has resulted in the endangerment and extinction of indigenous species (Mumaw, 1992; Dowding & Murphy, 2001). Dowding and Murphy (2001) noted that while the main threat to shorebirds elsewhere in the world is habitat loss or degradation, introduced predators are the primary threat to New Zealand shorebirds. The same is true for other types of New Zealand species. Over 40% of the terrestrial bird species present before human settlement are now extinct, and 10-12% of the world's endangered species are in New Zealand (Clout, 1997 in Dowding & Murphy, 2001; Richardson, 2001). Half of all New Zealand bird species are threatened, and New Zealand has the highest number of endangered species per capita in the world (Garland & Butler, 1994; Craig et al., 2000). Despite 30% of New Zealand's total land area being reserved, introduced pest species are degrading protected areas (Craig et al., 2000). Areas where indigenous species are kept safe from predators are on offshore islands, and on predator-free 'mainland islands' (Garland & Butler, 1994; Craig et al., 2000).

According to Craig et al. (2000), mining in the 1970s prompted support for conservation and the protection and preservation of indigenous species. A large number of indigenous species have species recovery plans to organise their recovery. The primary conservation methods used for indigenous species are predator and pest control, captive breeding and rearing programmes, and founding new populations by translocation (Dowding & Murphy, 2001). In

recent years, there has been widespread public support for conservation, and recovery programmes for species have generally been successful (Craig et al., 2000). However, Garland and Butler (1994) noted that while some reintroductions have been successful, the threats causing the species' decline must be addressed. They suggested that the heightened public awareness of conservation programmes, and captive breeding programmes in particular, will be beneficial for re-establishing indigenous species in the wild.

In addition to captive breeding of indigenous species, New Zealand zoos are involved with conservation through assisting with captive-breeding programme co-ordination; advocacy and education; research; and in-situ conservation (Butler, 1992). However, so far, the extent to which New Zealand zoos are contributing to the conservation of indigenous species through these activities has not attracted much research attention.

1.5 Research aim and objectives

The overall aim of the research is to evaluate the extent to which zoos in New Zealand contribute to the conservation of New Zealand indigenous species. In order to achieve this aim, five objectives were identified, each further detailed with their own set of sub-objectives.

Objective 1: Evaluate the current state of knowledge on zoos and conservation.

a) Undertake a systematic search for literature on the topic of zoos and conservation.

b) Critically evaluate the literature base and identify any gaps in the literature.

c) Identify and critically evaluate any established criteria for assessing and evaluating conservation by zoos.

Objective 2: Research the history and status of zoos in New Zealand.

a) Examine the history of zoos in New Zealand and the history of indigenous species in New Zealand zoos, and identify any relevant legislation.

b) Define and comprehensively identify all zoos in New Zealand.

c) Systematically obtain as much relevant information for each zoo as possible, including: location, legal status, and any history of indigenous species.

Objective 3: Investigate criteria which could be used to evaluate New Zealand zoos' contribution to conservation of indigenous species.

a) Critically select and/or establish appropriate conservation-related criteria which will apply to New Zealand zoos.

b) Systematically obtain as much information as possible for each zoo relating to the chosen criteria.

Objective 4: Evaluate whether or not (and to what extent) New Zealand zoos contribute to conservation of indigenous species.

a) Critically evaluate the information available and select criteria which can be used to evaluate zoos' contribution to indigenous species conservation. This could include criteria which facilitate or inhibit the amount zoos contribute to conservation of indigenous species, and criteria which distinguish zoos from one another.

b) Assess which form of evaluation would be best suited given the information collected and the criteria chosen.

c) Classify the zoos using the information collected in the database, according to the identified criteria.

Objective 5: Examine how practitioners in New Zealand evaluate zoos' efforts to conserve indigenous species.

a) Evaluate zoos' contribution to conservation, from the perspectives of conservation practitioners.

b) Investigate how zoo practitioners evaluate their efforts to conserve indigenous species.

1.6 Terminology

There are a variety of definitions of a zoo in the literature. The South East Asian Zoos Association Constitution (2002) defines zoos as including "*zoological gardens, biological parks, safari parks, public aquariums, bird parks, reptile parks, insectariums, and other collections of wildlife primarily for public exhibition, education, scientific, and conservation purposes*" (SEAZA 2002:1). According to Linke and Winter (2011), the 1993 World Zoo Conservation Strategy defines a zoo as an institution which houses a collection of wild (non-domesticated) animals, and displays at least part of the collection to the public. A definition by Alexander (1979: 99, as cited by Mason, 2000: 333) hints at a broader purpose and function of zoos: "*A zoo contains a collection of labelled animals to be protected and studied while incidentally providing enlightenment and enjoyment*".

The definition of a zoo used for this research is: 'An institution which houses a collection of terrestrial wildlife and is open for members of the public to view the animals'. Aquariums and other animal attractions (such as insectariums or butterfly houses) were excluded from this research due to time constraints except for where they hold terrestrial wildlife. New Zealand has a variety of sanctuaries for native flora and fauna, some of which are surrounded by predator-proof fences to protect the species inside the sanctuary. Interestingly, since a large proportion of indigenous birds are flightless, the birds are effectively in captivity. Therefore, many of these could be included in a broad definition of a zoo, such as 'housing a collection

of wildlife and is open to the public'. The definition of a zoo used for this research was formed with this in mind, and added that, unlike many sanctuaries, the public visit a zoo with the purpose and expectation of seeing the fauna inside.

In addition to their taxonomic names, New Zealand species are often known by at least two common names in Maori and English. In this thesis, the species will be referred to by one common name, and the taxonomic name when it is first mentioned each chapter. A complete list of the New Zealand species mentioned in this thesis is shown in Appendix A with the species' multiple names. Similarly, acronyms will be written in full when they are first mentioned each chapter, and a list of acronyms used in this thesis is in Appendix B.

1.7 Structure of thesis

This thesis is comprised of six chapters. Chapter Two evaluates the existing literature relating to conservation in zoos, both internationally and in New Zealand. A discussion is given on the multiple roles of zoos, particularly in regards to ex-situ conservation, in-situ conservation, and education. The review also investigates the existing methods of measuring or evaluating conservation in zoos.

Chapter Three provides a detailed description of the methods used for the research. The rationale for the selection of the methods is explained, and a discussion of the potential limitations of the methods is given.

Chapter Four begins with a presentation of the results gathered from the database compiled in the research. The evaluation is described in detail and is used to select three zoos as case studies. The final section of the chapter is focused on the key themes identified in interviews with conservation practitioners and zoo practitioners from the selected case study zoos.

Chapter Five discusses the research findings in depth. The themes identified in the interviews are explored in relation to the results from the database and evaluation, and to the literature discussed in Chapter Two.

Chapter Six, the concluding chapter, begins by revisiting the research aims and discussing the implications of the research. This is followed by recommendations for zoos on the most effective methods to increase their contribution to indigenous species conservation. Potential applications of the research and the effectiveness of the research methods are discussed. Opportunities for further study are identified, and the thesis concludes with a final discussion on zoos' contribution to conservation in New Zealand.

Chapter 2
Literature Review

This literature review begins with an examination of the roles of zoos, with a focus on the links between zoos and tourism. The review then focuses on conservation in zoos, through both ex-situ and in-situ conservation. The role played by education in the forms of visitor education and research is also introduced. This is followed by an evaluation of the New Zealand literature on conservation in zoos. The chapter concludes with an investigation of existing methods of evaluating conservation in zoos.

2.1 The roles of zoos

Zoos have been metaphorically described as 'arks' preserving endangered species, or as museums with living collections (Mason, 2000; Frost, 2011; Mason, 2011). Frost (2011) dismissed the description of zoos as arks because in recent years it has been acknowledged that only preserving a breeding population is not enough for conservation. It is now recognised that zoos perform a variety of roles that could arguably contribute to nature conservation. It could also be argued that the description of zoos as museums with living collections should also be questioned, because the roles that zoos perform extend beyond collecting and labelling animals for the education and enjoyment of visitors. Most importantly, museums teach their visitors about history, while animals in zoos are used as ambassadors for their species in order to teach their visitors about how they can help with conservation in the future. Indeed, encouraging visitors to transfer their caring from individual animals they see in zoos to wider conservation issues was recognised by Dickie, Bonner, and West (2007) as one of zoos' most important roles.

Researchers have identified a range of roles for zoos. For example, Jamieson (1985) identified zoos' roles as amusement, education, scientific research, and species preservation. Shackley (1996: 114-115) suggested eight roles which zoos fulfil, many of which are similar to Jamieson's (1985):

- educating people about animals;
- conserving endangered species;
- safeguarding the welfare of visitors;
- entertaining visitors to generate revenue;
- providing visitor facilities, such as catering and merchandising;
- breeding animals to halt the species' decline in the wild;

- re-introducing captive-bred animals to the wild;
- carrying out zoological and veterinary research to improve animal welfare in the wild and in captivity.

Bostock (1993) also stressed the recreational value of zoos, in that zoos are places for people to meet, and sometimes engage with, real animals. A number of other authors highlighted this range of roles played by zoos, namely conservation, education, and entertainment, but importantly added that the roles are often interconnected rather than separate (Broad, 1996 in Mason, 2000; Ryan & Saward, 2004; Frost, 2011; Mason, 2011).

Education and entertainment are often thought to be inter-related because many zoos present information about their animals in a manner which is entertaining for visitors. An example is having informative talks led by zookeepers while the animals are fed. Conservation and education are also linked because zoos educate their visitors about the threats faced by species in the wild. Furthermore, zoos can teach visitors how to change their behaviour in order to benefit conservation. Finally, conservation can also be entertaining for visitors. Shackley (1996) suggested that allowing animals to engage in functions such as gathering food as they would in the wild is entertaining for visitors. This example covers all three of the main roles of zoos. While the visitors are being entertained, they are also being educated about the way that the animals function in the wild. Conservation is possibly aided in that the animals are prevented from becoming too domesticated, which can be a barrier to reintroduction to the wild.

Frost (2011) suggested that with such diversity of roles to fulfil, zoos might suffer from an identity crisis: "*with managers, visitors and other stakeholders not sure whether zoos are protected areas for nature or visitor attractions or some sort of hybrid*" (Frost, 2011: 5). Such a diversity of roles can also put a strain on zoo resources. In a review of zoo contributions to conservation and education in England (DEFRA, 2010), the authors stated that conservation work is often constrained by funding, and that smaller zoos may find conservation activities more difficult.

There is much debate among researchers as to whether zoos are fulfilling their education and conservation roles sufficiently to justify keeping animals in captivity, or whether zoos' primary focus is still on entertainment. Despite the amount of research conducted on this topic, there appears to be no conclusive agreement reached between researchers. Instead, the general consensus seems to be that more research is needed, because "*for zoos to be acceptable in modern society, they need to make a worthy contribution to conservation and*

education" (Frost, 2011: 228). The question of what constitutes 'worthy' is important, but is rarely addressed in the literature.

Shani and Pizam (2011) acknowledged that in addition to the roles discussed above, zoos make a contribution to the economy, through foreign exchange by tourists, employment, and the purchase of goods and services in the local area. They noted that tourists are visitors to zoos as well as local residents, and the involvement of zoos with tourism is a relatively new area of study (see Frost, 2011).

2.1.1 Zoos and tourism

Although zoos have traditionally been perceived as recreational attractions for local people, they are increasingly being acknowledged as attractions for tourists too, and they can form part of the attributes of a destination (Frost, 2011). Mason (2000) highlighted Berlin, Copenhagen, and Rotterdam zoos as major urban attractions, but also noted that zoos as tourist attractions are under-researched. This is apparent in the figures that Mason (2000) used since he identified only the total number of visitors to the zoos and did not separate tourists from locals.

While tourists cannot be differentiated from local visitors, studies suggest that entertainment is the primary motivation to visit a zoo. Shackley (1996) found that only 6% of visitors to zoos in the UK were motivated by learning about animals and conservation, while 48% visited 'for a day out', and 40% visited to entertain their children. Similarly, Ryan and Saward (2004) found in a study of Hamilton Zoo, New Zealand, that visitors were more interested in entertainment than education. Körner (2010) surveyed adult visitors of family groups to find their motivations in visiting Orana Wildlife Park and Willowbank Wildlife Reserve, both in Christchurch, New Zealand. Although 1% of visitors at Orana Park and 0% of visitors at Willowbank answered that education was a motivation in visiting the attraction, Körner (2010 identified 'edutainment' (a combination of education and entertainment) as part of the overarching family experience at the attractions. Similarly, Linke and Winter (2011) found that people visit a zoo primarily for entertainment, and also noted that modern zoos make an effort to provide education that is entertaining.

Ryan and Saward (2004) argued that zoos cannot substitute viewing wildlife in their natural setting, but Mazur (2001, cited by Catibog-Sinha, 2008) suggested that zoos could stimulate visitors to travel to the animals' natural settings and see the animals in the wild for themselves. Conversely, it was also pointed out by Mason (2000) and Catibog-Sinha (2008) that zoos could be a better eco-tourism attraction than viewing animals in the wild, because of

the damage that tourists cause to remote ecosystems. Wearing and Jobberns (2011) suggested that eco-tourists travel long distances and cause impacts on remote, previously undeveloped areas, and cited Tremblay (2008) in suggesting that viewing animals in captivity would satisfy the wants of eco-tourists while also preventing them from damaging the environment. If the zoo visited by eco-tourists is contributing to in-situ conservation, it means that eco-tourists could be benefiting conservation as well as avoiding the negative impacts they would cause by going into the wild. These negative impacts can include negative behaviour changes in wildlife (including disruption of breeding patterns), dependency on humans for food, and death, including high infant mortality rates (Wearing and Jobberns, 2011). Other negative impacts of tourism on the natural environment can include pollution and loss of vegetation (Hall, 2003). Tourism in wilderness and protected areas is one of the quickest growing sectors in the tourism industry (Mowforth & Munt, 2003), and as tourism in these areas intensifies, the negative impacts on the environment will inevitably increase (Wall & Mathieson, 2006).

West and Dickie (2007) also recommended that zoos develop eco-tourism projects, but focused on the human impacts of eco-tourism rather than natural impacts. They noted that the fates of many species and local peoples are linked, and proposed that zoos work with the residents of the area so that their lives and livelihoods are not compromised.

2.2 Conservation in zoos

The general consensus of the literature is that zoos are contributing (or at least have the potential to) contribute to conservation. Frost (2011) indicated that it is common to see major zoos using marketing campaigns to convince the public that their zoo is heavily involved with conservation, and suggested that some zoos are engaging in a form of 'green-washing' by claiming they are making a much larger contribution towards conservation than they really are. Frost (2011) used the example of a North American zoo opening a 'Chimpanzee Conservation Center' which was really only a new exhibit and did not do anything more to contribute to conservation. Similarly, Hancocks (2007) pointed out that many zoos are now calling their exhibits 'habitats', and implied that this is an example of zoos making themselves appear more focused on conservation and nature rather than entertainment as in the past. However, these suggestions that some zoos are not engaging in conservation to the standard that they claim mention only some zoos, not all. There are also many examples of literature supporting zoos' efforts towards conservation, which are explored next.

Zoos in the United Kingdom are required by the Zoo Licensing Act 1981 to participate in conservation and education measures. Each zoo's contribution is expected to be proportionate

to its size and type, although exemptions are given to small zoos (DEFRA, 2010). According to DEFRA (2010), zoos are given the following options of conservation measures to choose from: participating in research which benefits conservation of the species; training in relevant conservation skills; the exchange of information relating to species conservation; and captive breeding, repopulation or reintroduction of species into the wild. According to the DEFRA report (2010), of the responding zoos with no exemptions: 94% participated in research projects, 100% were involved with field conservation projects (of which a majority included conservation training and 77% included re-introductions or re-populations), 94% exchanged information relative to species conservation, and 94% reported involvement in captive breeding.

Frost (2011) usefully critiqued the description of zoos as arks, because in recent years it has been realised that zoos are involved with conservation more than only preserving a breeding population. He suggested that the conservation strategies zoos are engaging in have up to three components: global collaborations (involving zoos, conservation bodies, and protected area agencies); working on conservation projects in the animals' natural habitats; and delivering conservation messages to zoo visitors. The global collaboration component would be of particular importance to the breeding programmes in zoos, but it is conceivable that global collaborations could also promote new research and suggestions for best practice.

Most conservation taking place in zoos, by default, is ex-situ conservation. It is defined in the literature as conservation outside of the species' natural habitat, where the animals are kept in captivity. On site, zoos use captive breeding and reintroduction of species into the wild, visitor education, research, animal welfare, and environmental enrichment (Catibog-Sinha, 2008). Alternatively, in-situ conservation takes place in the species' natural habitats. In recent years, zoos have increasingly become involved with in-situ conservation initiatives to conserve species and habitats in the wild in addition to the ex-situ conservation taking place inside the zoo.

Habitat loss and degradation is a contributing factor to the decline of populations in the wild (see, for example, Conway 2010). The International Union for Conservation of Nature (IUCN), the US Endangered Species Act, and Article 9 of the 1992 Convention on Biological Diversity (CBD) recognised this and recommended that in-situ conservation should be combined with ex-situ approaches, such as captive breeding in zoos and aquariums (United Nations, 1992; Conde, Flesness, Colchero, Jones, & Scheuerlein, 2011). The importance of both approaches is summarised by Vrijenhoek (1995:75):

> "*Clearly, our primary goal must be to preserve habitats and the ecosystem processes that govern them. Simultaneously, to avoid demographic extinction of threatened and endangered species, we must secure remnant populations*".

The remainder of this section on conservation will be divided into discussions on ex-situ conservation (focusing primarily on captive breeding and reintroduction) and in-situ conservation. They will be followed by a separate section focusing on education.

2.2.1 Ex-situ conservation

According to Beck (1995), more than 13 million captive-bred animals have been re-introduced to the wild, of which at least 70,000 were mammals, birds, and reptiles. Beck (1995) also stated that zoo-born animals were involved in 76 (50%) of the 129 re-introduction programs studied. There has been much controversy as to whether taking animals into captivity is either necessary or acceptable. For example, Lee (2005) argued that zoos cannot conduct ex-situ conservation properly while allowing visitors to view the animals, and suggested that zoos focus on contributing to in-situ conservation while leaving ex-situ conservation to specialist centres. By contrast, Tudge (1992: 1) stated: "*zoos are now an essential part of modern conservation strategy; and that of the several tasks that fall to them, by far the most important is the breeding of endangered animals*".

There are multiple examples in the literature of zoos performing poorly with captive breeding, and authors stated that historically most reintroduction attempts have failed (see, for example, Bowkett, 2009, and Frost, 2011). One of the examples that Frost (2011) gave was the thylacine (*Thylacinus cynocephalus*), a marsupial indigenous to Australia and commonly known as the Tasmanian Tiger or the Tasmanian Wolf. According to Frost (2011), thylacines had been displayed in zoos in London, Washington, Vienna, Paris, and Antwerp from 1850 onwards, but no captive breeding or habitat conservation was attempted. The last known thylacine died in captivity at Beaumaris Zoo, Hobart, in 1936 (Frost, 2011).

There are also some notable examples of successful reintroductions into the wild after captive breeding in zoos. Conde et al. (2011) cited the 2010 study of the IUCN Red List by Hoffman et al. and pointed out that of the 68 species whose threat level was reduced, captive breeding played a major role for 17 of the species. Commonly cited examples of species aided by captive breeding and subsequent reintroduction are shown in Table 2.1 on the following page. Some authors, however, have also suggested that the species were not saved because of captive breeding. Frost (2011) suggested the species were saved through captive breeding because of good luck. Loftin (1995) argued that setting aside the Poco das Antas reserve and

educating the local people to protect wild golden lion tamarins (*Leontopithecus rosalia*) was more important than the release of captive-bred tamarins into the reserve.

Table 2.1: Commonly cited examples of species aided by captive breeding and reintroduction (Catibog-Sinha 2008; Conde et al. 2011; Frost 2011).

Common name	Scientific name
Przewalski's wild horse	*Equus ferus przewalskii*
Black-footed ferret	*Mustela nigripes*
California condor	*Gymnogyps californianus*
Arabian oryx	*Oryx leucoryx*
American bison	*Bison bison*
Père David's deer	*Elaphurus davidianus*
Golden lion tamarin	*Leontopithecus rosalia*

Despite its largely unsuccessful history, captive breeding for reintroduction as a conservation strategy had gained widespread recognition by the early 1990s from conservationists and the general public (Bowkett, 2009). As a result, research into captive breeding and reintroduction attempts and techniques has increased markedly in the last two decades.

Criticisms of captive breeding are readily available in the literature. For example: captive breeding is costly; hybridisation can occur (breeding between two animals of one species which are later separated into two species according to new taxonomic findings); animals bred in captivity could miss out on learning skills which allow them to survive in the wild; there is limited space in captivity; some species do not survive or breed well in captivity; and financial and technological constraints prevent some zoos from being able to release captive-bred animals into the wild (Tribe & Booth, 2003; Catibog-Sinha, 2008; Conde et al., 2011).

Similarly, reintroduction projects face issues such as financial cost, risk of disease, the inability of reintroduced animals to adjust to the wild, losses of life in the early phases of release, global climate change affecting habitats, unsustainable harvesting of the species, and restoration ecology (West & Dickie, 2007; Stanley-Price & Fa, 2007).

Along with these problems and criticisms, however, a range of solutions and recommendations for best practice have been suggested. For example, Conde et al. (2011) offered a solution to the concern that Puerto Rican parrots (*Amazona vittata*) bred in captivity would be unable to escape predators in the wild. This was solved with an aviary-based stimulation and exercise program for the birds before they were released. A number of authors recommended that zoos specialise in captive breeding a select few species because

specialisation increases breeding success due to specialised facilities and increased expertise (see, for example, Catibog-Sinha, 2008; Conway, 2010; Conde *et al*., 2011).

Another widely voiced recommendation is that the breeding programme for any one species should be collaboratively managed with a network of zoos and relevant organisations (WAZA, 2005; Catibog-Sinha, 2008; Conway, 2010). Although any one zoo will have a population too small to be able to sustain a programme on its own, the zoos of the world collectively have a much larger population. By collaborating and arranging transfers of individual animals, genetic diversity can be better maintained and the breeding programme for the species has enhanced potential (Conway, 2010).

Additional benefits for conservation of ex-situ breeding programmes are highlighted by Baker (2007). These include: the captive populations are a genetic and demographic reservoir, safe from disease; technology for reintroduction can be developed and tried out on the captive population; the animals are used as ambassadors for fundraising for in-situ conservation; and collaborative management of species collections helps to build coalitions between different zoos and institutions.

Bridgewater and Walton (1993) provided an example of how ex-situ conservation can continue to advance. They suggested that in order to show visitors how species interact and function in natural systems, terrestrial animal and plant species could share the exhibits with aquatic animal and plant species. The authors described the institutions as ‘biological parks’ or ‘biological conservation centres’. They could potentially help with conservation of plant species in addition to conservation of animal species.

Zoos can also contribute to conservation inside the zoo which does not directly relate to the animals. West and Dickie (2007) suggested that it would be hypocritical of zoos to promote conservation awareness without managing their own resources carefully, and recommended that zoos focus on environmental auditing, the ecological footprint of the zoo, and carbon neutrality. Other ‘environmentally friendly’ ways suggested in which zoos can operate their facilities include conserving energy and water, using non-polluting fuel, and offering environmentally friendly food and merchandise (Rabb & Saunders, 2005).

2.2.2 In-situ conservation

Zoos are increasingly engaged in in-situ conservation efforts, and according to Tribe and Booth (2003), the number of in-situ conservation projects being supported by the Association of Zoos and Aquariums (AZA; primarily comprised of zoos in the United States of America (US)) doubled from 325 in 1992 to 650 in 1999. Similar growth occurred in the United

Kingdom (UK), which was illustrated by the monetary contributions of federated zoos to in-situ conservation: US$4.5 million was donated by federated zoos in the UK in 1995, and this figure rose to US$15 million in 2000 (Tribe & Booth, 2003).

The 2005 Conservation Strategy written by the World Association of Zoos and Aquariums (WAZA) reflects this growing emphasis on conservation in the wild rather than in captivity: "*conservation is the securing of long-term populations of species in natural ecosystems and habitats wherever possible*" (WAZA, 2005:9). Stanley-Price (2005) quoted the strategy as recommending that ideally, zoos should increasingly set their primary goal and focus to committing to conservation in the wild. WAZA has 22 national or regional associations as members, including ZAA and AZA, and according to Gusset and Dick (2010), WAZA membership requires a binding commitment to conservation. Stanley-Price (2005) also suggested that because zoo representatives in their association will generally know each other, zoos will back up global and regional commitments to conservation because of peer pressure. It is also possible that pressures to present an image of the zoo being committed to conservation to the public, as Frost (2011) suggested, will influence zoos to join in with global and regional conservation efforts. According to Conde et al. (2011), WAZA are the third largest contributor to in-situ conservation after the Nature Conservancy and the World Wildlife Fund, with a total contribution of approximately US$350 million per year.

Conway (2010) gave the example of the Bronx Zoo's Congo Gorilla Forest exhibit as a direct method of contributing to in-situ conservation. The zoo added an extra fee for the exhibit to support conservation in tropical African forests, and also provided touch-screens to allow visitors to choose from a number of ways their money could be spent on conservation. In 2009, ten years after the exhibit opened, it had raised and spent US$10.6 million on African tropical forest wildlife conservation. Zoo Boise (in Idaho) described itself as "*a garden or park where wild animals are kept for exhibition for the primary purpose of generating funds for the conservation of animals in the wild*" (Burns & Beinemann in Conway, 2010: 4). This shows that in addition to prioritising conservation over all other roles of Zoo Boise, the zoo also places emphasis on in-situ conservation rather than ex-situ conservation.

Christie (2007) wrote that generating funds for conservation is now being supported by the zoo community as a valid contribution to conservation. She provided the example of the Australasian Regional Association of Zoological Parks and Aquaria (ARAZPA; now ZAA) establishing their Wildlife Conservation Fund for members to contribute to in-situ conservation projects. The fund raised over AU$100,000 between 2001 and 2007 for in-situ projects in Australasia and south-east Asia (Christie, 2007). Some zoos have allocated at least

10% of their annual budget to in-situ conservation activities (Hatchwell, Rübel, Dickie, West, & Zimmerman, 2007).

As with ex-situ conservation, authors recommended that zoos collaborate and combine their efforts in order to achieve better results (Tribe & Booth, 2003; Stanley-Price, 2005). Conde et al. (2011) argued that it is vital that conservation organisations and policymakers consider the potential that can be provided by zoos contributing to in-situ conservation as a global network. This co-operation and collaboration could include lending expertise to an in-situ project, providing financial support, or supplying zoo-born animals to an in-situ project. Tribe and Booth (2003) further recommended that local people and organisations should also be involved with co-ordinating zoos' in-situ conservation projects.

Various authors have suggested that zoos should associate closely with a particular area of unprotected habitat. Conway (2003) discussed zoos owning the land, either individually or through a coalition of zoos, and supporting the reserves by using some of the animals for zoo exhibits. He also noted that the reserves would protect habitat, provide local incentives for conservation, and that they could be a constructive alternative to expensive captive breeding programmes. Hatchwell et al. (2007) also described extractive reserves similar to those suggested by Conway (2003). However, they differed in that the extractive reserves would be owned and controlled by the local community rather than by zoos. The authors wrote that in theory, the extractive reserves could provide a legal, sustainable source of animals; the natural habitat would be protected; and it would benefit the livelihoods of local people. While an arrangement such as this where the local community owns and controls the natural resources appears to be more beneficial for the community, it also appears that the zoo is less involved with in-situ conservation.

According to Hatchwell et al. (2007), there are enough linkages between the Masoala exhibit in Zürich and the Masoala National Park in Madagascar that the exhibit is perceived by the zoo-going public as an outpost of the national park. Zoo Zürich (2011) stated that the Masoala rainforest exhibit is "*the centrepiece of the zoo's nature conservation strategy*", and that donations from the exhibit provide one third of the long-term funding needed to conserve the national park. Although the zoo does not own the land as in Conway's (2003) suggestion, it appears that a close partnership such as this with an area is beneficial to both the zoo and the national park.

A final argument in support of zoos' involvement with in-situ conservation is that in-situ conservation provides an opportunity for research. The research could be carried out by the

staff directly involved with the in-situ conservation project, sponsored by the zoo, or even conducted by external researchers. Studies in captivity and the wild can complement each other (Hearn, 1987, as cited by Bostock, 1993: 162), which means that zoos with in-situ conservation projects are ideally positioned to conduct research on their captive animals and their wild counterparts. Additionally, Bostock (1993) argued that if field research sponsored or conducted by zoos was no longer associated with the zoos, then the research could stop entirely.

2.3 Education in zoos

There is substantial literature published on zoos' involvement with conservation education. For the purposes of this literature review the material is divided into two categories: educating the visitors to the zoo, and education in the form of research that is carried out by zoo staff and collaborators.

2.3.1 Visitor education

One of the key reasons cited for the existence of zoos is that zoos are often the main (or even only) point of contact between people and wildlife, especially in cities in developed countries, and that zoos are therefore necessary for education (Linke & Winter, 2011; Shani & Pizam, 2011; Wearing & Jobberns, 2011). Hutchins (1999) also agreed with the difficulties of urbanising populations becoming separated from nature, and added that people will not conserve wildlife if they do not appreciate it and understand its value.

As the world's population increasingly becomes more urbanised and recreation choices accordingly become more urban based, zoos will become even more important as the main link between people and wildlife. West and Dickie (2007) added that the majority of visitors to zoos in developed countries will never see a gorilla or a tiger in the wild, but they are also the most financially able to donate money to conservation. It is shown in the literature that zoos see themselves as raising awareness of conservation issues by educating their visitors; however, there is also much debate as to whether or not the visitors are actually learning during their visit to the zoo.

On a global scale, the large amount of visitors to zoos gives zoos the opportunity to educate a vast number of people about conservation and potentially influence their behaviour. As mentioned in the Chapter One, 600 million people visit the 1000 zoos and aquaria associated with WAZA each year (WAZA, 2005). Michael Hutchins, director of conservation and science for AZA, estimated that approximately 140 million people go through AZA zoos every year, which is about half of the US population (Ebersole, 2001). As Stanley-Price

(2005: 109) also commented, the amount of zoo visitors is 'staggering', and suggested that: "*each visitor is an opportunity for the demonstration of the wonders of nature... and messages about conservation. No office-based organization can showcase conservation so well.*"

The World Zoo and Aquarium Conservation Strategy emphasised the need for education, and stated that the education should "*induce a feeling of wonder and respect for the web of life and our role in it; it should engage the emotions and build on this experience to create a conservation ethic that can be carried into action*" (WAZA, 2005: 38). This quote suggests that rather than teaching only facts about the animals, the zoos should educate further about conservation and advocate for conservation action. Furthermore, Balmford, Leader-Williams, and Green (1995), argued that due to zoos' ability to offer an experience of living animals and raise awareness of conservation issues, conservation education is the most important role of a modern zoo.

2.3.2 Research and zoos

In addition to educating zoo visitors about animals and conservation, zoos offer opportunities for researchers to study animals in captivity. One of the eight roles of zoos that Shackley (1996) identified was to carry out zoological and veterinary research in order to improve animal welfare both in captivity and in the wild.

Bostock (1993) identified eight ways in which zoos can help science: taxonomy, general observation and investigation, breeding technology, veterinary study, genetics, behaviour, and as a source for anatomical material. Additionally, Bostock (1993) noted that zoos can act as a focal point and contribute to science through scientific and conservation-related meetings, or through the publication of scientific journals. The aims of scientific research in zoos were also identified by Bostock (1993): to add to biological knowledge; to assist in the care and breeding of animals in zoos; to assist management and conservation of animals in the wild; and possibly to assist in the solution of human medical problems.

The research conducted in zoos reaches outside the zoo boundaries. According to Stanley-Price (2005), zoos teach skills which are needed in the field, such as handling and caring for animals, intuitive understanding of animals, rigour in practice and standards, and adhering to schedules. He further suggests that zoos should be the primary source of skills and short-term help for species recovery and conservation. Research is also conducted by zoos in the field, as discussed earlier in the section on in-situ conservation.

The World Zoo and Aquarium Conservation Strategy stated a vision for zoos to become "*serious, respected scientific institutions that make significant contributions*" in terms of wildlife and wildlife conservation (WAZA, 2005: 20), and Catibog-Sinha (2008) suggested that zoos partner with other research and academic institutions, including universities, in order to achieve this. Furthermore, Catibog-Sinha (2008) suggested that in addition to conservation research, zoo tourism research in areas including visitor impact management, visitor learning, exhibit evaluation, and marketing should be carried out.

In a report prepared for ARAZPA, the authors wrote that due to the high degree of endemism in Australia, *"…any effort to conserve native species is arguably valuable, regardless of the number of species or specimens within a species that are saved*" (Aegis Consulting Australia and Applied Economics, 2009). This perspective highlights the importance of education, because education would be the most valuable outcome of a failed conservation attempt. No matter how unsuccessful the programme is, the zoos have an opportunity to educate the public while the programme is in place and advocate for the species. There is also a research value in terms of any new knowledge gained during the conservation programme. Even knowledge as simple as finding out what methods to avoid in the future could potentially have a benefit for conservation in years to come. Like Australia, New Zealand's indigenous species are highly endemic (Daugherty, Gibbs, & Hitchmough, 1993), and it is arguable that conservation efforts to conserve New Zealand indigenous species are similarly valuable to those in Australia. The following section discusses the available literature on conservation of indigenous species in New Zealand zoos.

2.4 Conservation of indigenous species in New Zealand zoos

In addition to breeding indigenous species in captivity, Butler (1992) noted that New Zealand zoos perform a variety of roles. These are: assisting with co-ordinating captive breeding programmes; advocacy and education; research; and assisting with in-situ conservation. These roles reflect those described in the international literature, namely, conservation and education.

Zoos in New Zealand have suggested that keeping indigenous bird species in captivity at zoos is beneficial to research. For example, in an article by Griggs (2006), Alison Lash (executive director of Wellington Zoo) stated that studying kiwi (*Apteryx* sp.) at Wellington Zoo could help scientists understand more about their diets, since the only knowledge available then was from roadkill. She hoped that information gained from indigenous species in captivity at the zoo could aid the Department of Conservation (DOC) in the wild. Atkinson-Renton (2004)

used the example of eight mohua (*Mohoua ochrocephala*), which were captured from the wild and transferred to Orana Wildlife Park in Christchurch in September 2003. Two months later, three eggs had been laid, which was the first time that mohua had been known to use an artificial nest site, and all three eggs hatched. However, by May 2004, five of the mohua died due to avian malaria. This was the first time that avian malaria had been known to affect mohua, and despite the loss of the individuals, research was prompted that could potentially prevent more deaths (possibly in other species in addition to mohua) due to avian malaria in the future.

Under the Wildlife Act 1953, the native species of New Zealand are fully protected and their ownership is vested in the Crown (Butler, 1992). Additionally, the Conservation Act 1987 created the Department of Conservation with the roles of, among others, managing land and natural resources for conservation purposes, and advocating for the conservation of natural resources in general. Because of this legislation, it appears that New Zealand zoos are closely linked with the Department of Conservation. For example, DOC controls where threatened indigenous species may be kept in captivity, the transfer of animals between institutions, and all breeding programmes for indigenous species (Butler, 1992). This means that any zoos holding indigenous species and undertaking a breeding program do so with the awareness and approval of DOC. A number of breeding and rearing facilities used by DOC are in zoos, in addition to the facilities owned by DOC or other institutions.

It is not uncommon for a combination of institutions to take part in the programme for a species, including DOC, zoos, universities, and private conservation facilities. According to Butler (1992), DOC is increasingly implementing new captive breeding programmes in zoos. In 2001, Peter Morton from DOC opened his presentation on kiwi releases at the New Zealand Conservation Management Group (CMaG) Annual Conference by stating, "*we have found that working in partnership with Rainbow Springs [Kiwi Wildlife Park], Massey University, and local iwi [the Maori word referring to a Maori tribe or people] has allowed more to be achieved for kiwi in the Ruapehu Area than the Department of Conservation could have done by itself*" (Morton, 2001). Prior to CMaG merging with ARAZPA (now known as ZAA) circa 2004, publications of the annual conference proceedings showed that the management of indigenous species involved collaborations between multiple zoos, along with DOC and in some cases, universities and individuals. For example, the table compiled to show the 1999-2000 breeding season for blue duck (*Hymenolaimus malacorhynchos*) listed eight zoos, five individuals, two parks, and Peacock Springs (Morton, 2001).

In the same conference in 2000, Martin Bell detailed a DOC conservation project for tuatara (*Sphenodon* sp.), which again helps to illustrate the connections between institutions in New Zealand. Thirty-one tuatara were captured in 1990 from Stanley Island, Red Mercury Island, and Cuvier Island, and taken to Auckland Zoo. Three eggs were produced which were then sent to Victoria University, where they were incubated and hatched before being sent to Otorohanga Kiwi House to be reared. In 1993, the Stanley Island tuatara were then transferred to Hamilton Zoo and Wellington Zoo (Bell, 2000). This example illustrates the use of zoo facilities in DOC projects, and also the collaborations of multiple institutions, including zoos, in a conservation project. The example also demonstrates how ex-situ conservation can be beneficial to a species, because according to Cree *et* al. (1991 and 1993, as cited by Bell, 2000), there appeared to be a lack of food in the wild, some tuatara were widely dispersed, many of the tuatara were in poor condition, and there was no evidence of young individuals in any of the populations. Zoos have also assisted DOC with research and method design for threatened species. For example, Sibley (1994) described the development of incubation and hand-rearing techniques by staff at Auckland Zoo on the non-endangered kea (*Nestor notabilis*) and kaka (*Nestor meridionalis*) for the purpose of the recovery plan for the endangered kakapo (*Strigops habroptila*), initiated by DOC.

According to Frances and Warren (1999), while the law has a key role to play in biodiversity conservation, it is primarily a management issue rather than a legal issue. They give the example of the partners that DOC collaborates with - in the Auckland area for biodiversity conservation: Ngati Wai for co-operative conservation management and whale stranding protocol; Auckland Regional Council for species recovery including kokako (*Callaeas cinereus*); Auckland Zoo for captive breeding of threatened species; and others including the Botanical Gardens and the Royal Forest and Bird Protection Society.

Macdonald (2012) highlighted the financial issues facing conservation in New Zealand. Despite a 2005 review finding that DOC was not halting biodiversity decline, the DOC budget was cut by $54 million in 2009. According to Macdonald (2012), this led to DOC relying more heavily on commercial partnerships for conservation funding. A notable example given by Macdonald (2012) is the BNZ Save the Kiwi Trust. According to Macdonald (2012), the Bank of New Zealand (BNZ) supplements $4.5m of DOC funding for the Trust, although the 2011 contribution of $810,489 had diminished from the $1,172,215 the year before. The main topic of the article, however, focused on Rio Tinto's withdrawal of their $200,000 annual contribution to the Kakapo Recovery Programme. Macdonald (2012) suggested that while business partnerships are beneficial to conservation, they are also not

reliable – especially in difficult economic times. Butler (1992: 8) discussed co-operation between DOC and zoos, and stated that the pooling of resources has had "*significant benefits for species conservation*". In addition, Butler (1992) suggested that the continuation of the partnership between DOC and zoos may be vital for resolving species conservation issues in the future.

As discussed earlier, authors have recommended in the international literature that zoos work in collaboration with one other and with relevant conservation organisations. New Zealand zoos are collaborating in this manner, as shown with examples earlier in this section. It is possible that this interconnectivity of New Zealand zoos is due to DOC controlling the breeding programmes and where threatened indigenous species may be kept in captivity. If this is the case, New Zealand's existing laws protecting indigenous species may have inadvertently helped to form these collaborations between zoos. It also appears that Auckland Zoo's new Te Wao Nui exhibit focuses on an ecosystem approach with both fauna and flora, much like the holistic approach described by Bridgewater and Walton (1993). However, despite the availability of project-specific and species-specific information shown above, there is an obvious lack of published literature available which focuses on conservation in New Zealand zoos.

2.5 Existing assessments of conservation in zoos

According to Shani and Pizam (2011), the early classifications of animal-based attractions were based on the level of captivity at the attractions. Bostock (1993) identified six ways of keeping animals based on their living conditions, for example, whether their enclosure is naturalistic or not, or whether or not there is enrichment. Shackley (1996) also classified animal-based attractions according to the restrictions on the animals' mobility, and the motivations behind the attractions, such as conservation, education, and entertainment.

One form of evaluating conservation in zoos is through accreditation, which has been required of AZA zoos since 1980 (Maple, 1995). According to Maple (1995), AZA's accreditation system requires an on-site inspection at least once every five years, conducted by at least two experienced zoo professionals, and the zoo must meet high standards in animal management, facility cleanliness, veterinary care, financial stability, conservation, education, and stewardship. This accreditation system is strongly supported by both Maple (1995) and Conway (1995): "*it should be recognised that you cannot argue, beg, or force your way into accreditation – you have to earn it*" (Maple, 1995: 23). Conway (1995) noted that AZA institutions may be the only animal welfare or conservation organisations in the US which

subject themselves to regular inspections for accreditation, have a common code of ethics, and provide ongoing scientific instruction and training. Additionally, Maple (1995) supports the idea of a rating system for zoos, suggesting it would give each zoo a target, and that it would provide healthy competition for zoos.

Although many authors recommended an evaluation or assessment system for zoos' involvement with conservation, the authors also discussed the difficulties of establishing such a system. Gusset and Dick (2010: 183) indicated that large scale evaluations of multiple conservation initiatives and their outcomes are lacking, and that "*to date, there has been no compilation and assessment of the world zoo and aquarium community's contribution to in-situ conservation from the perspective of supported projects*". While there is an obvious need identified in the literature for evaluations of zoos in terms of their contributions to conservation, Hatchwell et al. (2007) noted that zoos are not the only conservation organisations faced with difficulties in evaluating their impacts. Studies on conservation education programmes, conservation investments, and long-term conservation projects were among those cited by the authors as also facing difficulties in evaluating conservation impacts.

Usher (1986:5) noted that evaluating conservation is often more intuitive than scientific: "*conservationists [have to] value sites in terms which are not economic but which are largely comparative...the use of the word 'best' implies that both value judgements and comparisons have been made: this is the process of evaluation*". However, Usher (1986) recommended quantification of criteria for repeatability and to reduce bias, and suggested a gradient system with steps or stages. The DEFRA (2010) report added that the difficulties in evaluating conservation are centred on being able to score and assess the various activities. The authors also noted that reaching a consensus may be difficult due to the large degree of subjectivity.

Miller et al. (2004) devised a set of questions to help evaluate how well a collection-based institution fulfils a mission of conservation:

- Does conservation define institutional policy decisions?
- Does the institution have significant organisational funding for conservation activities?
- Does the institution have a functional conservation department that performs conservation science and/or increases the capacity of others to do conservation?
- Does the institution advocate for conservation?
- Do the institution's conservation education programmes effectively target children and adults?
- Does the institution contribute directly to habitat protection, both internationally and locally?

- Do the institution's exhibits promote conservation efforts?
- Do the institution's internal operating policies protect the environment?

The above questions are described by the authors as "*a place to begin discussion*" (2004: 86), but do not provide any established methods to answer the questions. In contrast to these questions, which can be subjective, the DEFRA report (2010) suggested measuring inputs and outputs. However, DEFRA (2010) also noted that while the inputs are relatively easy to measure, the outputs are much more difficult.

The UK requirement for zoos to participate in a conservation activity could also be seen as a method of distinguishing zoos from one another, with the zoos complying and undertaking one of the required activities separated from the non-complying zoos. It is possible that a classification could be further based on how many conservation activities each zoo has undertaken and/or to what extent the zoo is participating with its chosen activities.

The evaluation tool developed by Mace et al. (2007) has been recognised by other authors in the literature (see, for example, Gusset & Dick, 2010; DEFRA, 2010). While it was developed for evaluating conservation projects rather than zoos, its basic method of quantifying the importance, volume, and effect of a project and using the equation 'importance x volume x effect = impact' could be applied to a zoo's conservation activities. Indeed, Wilkinson, Barton, Wilson, and Zimmerman (2011) used the equation when forming their Conservation Impact Assessment system, which is illustrated by the case study of the Kinabatangan Orangutan Conservation Project. They identified five criteria to assess (education, training, research, species, habitat), and assigned a value from 1-4 for importance, volume, and effect of each of the five criteria. When put into the equation by Mace et al. (2007), this gave a value for each criteria between 1-64, and then an average over the five values was calculated to give an overall score. In the case study, three assessors were used in order to compensate for subjectivity and bias, and an overall average between their three scores was used as the final score. Wilkinson et al. (2011) also suggested measuring conservation activity rather than conservation impact, because changes may not appear in the short-term, changes may not be directly due to action, and measuring activity involves less subjectivity and avoids possible bias.

Similarly, the report for ARAZPA on the contribution of zoos (Aegis Consulting Australia and Applied Economics, 2009) recommended that conservation projects undertaken by zoos be measured by the importance of the project to species or their habitats, the scale of the project, and the impact of the project. Furthermore, it was recommended that the importance, scale, and impact measuring system was used to assess the following five types of

conservation activities each zoo could be involved in: education and awareness; training of staff in relevant skills; research; species conservation; and habitat conservation.

Fabregas, Guillen-Salazar, and Garces-Narro (2011) also focused on zoos and their roles in conservation. First, the authors characterised and grouped zoos according to descriptive variables identified: ownership, association membership, location, age, size, diversity of animals, and percentage of endangered species. Twenty requirements were identified, based on the five requirements required by the European Community Zoos Directive, which relate to research, education, and conservation. These requirements were then assessed by the authors as either fulfilled or not fulfilled for each zoo.

It is clear from this review that the literature considers evaluations of conservation important but agrees that they are difficult and subjective. Much of the literature on evaluating conservation focuses on conservation projects rather than zoos. Given the multiple roles of zoos discussed earlier in this chapter, literature focusing specifically on evaluating conservation in zoos would be beneficial.

2.6 Summary

This review of current literature has shown that zoos are generally regarded to perform three broad, yet interwoven, roles of education, entertainment, and conservation. Zoos are also increasingly being recognised as tourist attractions. In general, the consensus is that zoos do have the potential to make a contribution to conservation through a variety of means, including ex-situ conservation, in-situ conservation, educating visitors, and conducting research. However, while many authors have identified the need to measure and evaluate zoos' contribution to conservation, there are relatively few studies that have advanced this important task. Furthermore, there is no evidence of evaluations being applied to New Zealand zoos or species indigenous to New Zealand. In addition, while there is information available on specific species and conservation projects in New Zealand, there is a lack of published literature focusing on conservation and zoos in New Zealand in general. The following chapter on methods describes how these gaps will be addressed in this study.

Chapter 3
Methods

The research comprises a variety of desk-based and field-based methods which were designed to be sequential in nature, meaning that research in the earlier stages determined the course of the research to follow. After the literature review was completed, information on zoos in New Zealand was systematically collected and compiled into a database. The database was then used to form a method of evaluating the zoos' contribution to conservation of indigenous species. Finally, a series of interviews was conducted in order to provide more insight into specific case studies of New Zealand zoos. The remainder of this chapter explains in detail the methods adopted in this research.

3.1 Desk-based research

Desk-based research has long been a part of research projects, particularly in the form of literature reviews. According to Moore (2006), some research projects are conducted using desk-based research alone. For this research, desk-based methods were used for the literature review and to gather relevant information on New Zealand zoos to use for the evaluation. In recent years, the internet has emerged not only as a source for knowledge in the form of literature, but also as a site for research in its own right (Gilbert, 2006). The internet was used in this study to gather information on zoos from their websites.

3.1.1 Literature Review

"*Most good research begins with a review of what has gone before*" (Moore, 2006: 106). Moore (2006) wrote that no research project exists in isolation, and that in order to be coherent and relevant it must take into account what research has already been conducted. Pickard (2007) described a literature review as a framework for the research, and a way to inform the study by learning from the experiences of other researchers. Objective One of the research objectives relates to undertaking a systematic review of the literature in order to critically evaluate the literature base in general, as well as literature relating to assessing conservation in zoos. The literature review was an important first stage of this study because it ensured that the research built on the existing knowledge base, rather than repeating research which had already been conducted.

As mentioned at the beginning of this chapter, the nature of this research was sequential, and the insights gained in the literature review were used to direct the later stages of the research.

The literature review was also used to provide a context for the research, by evaluating the current state of knowledge (both worldwide and specific to New Zealand) on the topic of conservation in zoos.

The literature was read with the first two sub-objectives in mind (finding literature on the topic of zoos and conservation, and finding any existing criteria or classifications for the contribution of zoos to conservation) in order to ensure that these sub-objectives were met. A critical analysis technique was used when reading each item of literature to best identify relevant pieces of information. This technique is described as "*reading with a purpose*" (Pickard, 2007: 29), and as each piece of literature was read its relevance was kept in mind with set questions to be answered. This method is similar to using a systematic review of the literature in that the literature was used to address specific questions (Petticrew & Roberts, 2006). However, the research topic is much broader than topics usually used for systematic reviews, and therefore several questions were used instead of only one.

The following questions were used to evaluate pieces of literature that related to conservation in zoos in general:

- Does this piece of literature agree or disagree that zoos contribute to conservation?
- What does the piece of literature show about what zoos are doing (or not doing) to contribute to conservation?
- How does this piece of literature relate to the research topic?
- How does this piece of literature relate to literature already found?

The questions below were used specifically for the items of literature which mentioned methods of evaluating or assessing conservation in general or conservation in zoos:

- What assessment method does the literature describe?
- Can this assessment method be applied to zoos in New Zealand?
- How does this assessment method relate to other assessment methods found?
- Does the literature indicate anything which could be used as a criteria to assess zoos' contribution to conservation?

The literature was then used to write a descriptive, synthesised review in order to show the scope of the existing research, and to compare pieces of literature and perspectives of authors. Fink (2010) defined a descriptive literature review as literature synthesised by the reviewer using their own knowledge and experience to evaluate similarities and differences in the research. A similar type of review was described as an integrative review by Neuman (2011), in which the current state of knowledge on the subject is presented and summarised, and the agreements and disagreements in the literature are highlighted. The literature was also used to

identify where there are gaps in the existing research, which was part of the second sub-objective.

The literature was obtained from a variety of sources, but primarily from peer-reviewed journal articles. These articles were found through catalogue searches, database searches, and sites where the journals are directly available (such as Oryx and the Journal of Sustainable Tourism, or sites such as SpringerLink). Other pieces of literature were found subsequently, as they were referred to in the journal articles. Other forms of literature were also used, including books, published reports and conference proceedings from organisations, and media articles where appropriate.

The information gathered on the collective history of New Zealand zoos and relevant legislation was primarily associated with the literature review. Some of the information was found in published literature and through a media database search. However, most of the information on the history of New Zealand zoos was found on websites of specific zoos, and usually related only to that particular zoo. Information on relevant legislation was obtained by a search of databases focusing on New Zealand law, and an internet search including websites of relevant stakeholders such as the Department of Conservation.

As mentioned above, the literature review was helpful in guiding the later stages of the research. This related particularly to the criteria that were chosen for the database and classification, and how the classification was structured. These will be further explained over the remainder of this chapter.

3.1.2 Database

A database is defined by the online Penguin Dictionary of Science (2009) as "*a computerized system for storing information in a structured, easily accessible form*". For the purpose of this research, a simple database was required to store and display the information gathered for each zoo. Two types of information were systematically collected and compiled to form a database. The first of these, in accordance with Objective Two, was general information on the zoos such as their individual histories and type of ownership. Secondly, information related to conservation for each of these zoos was collected, as intended under Objective Three. The methods for first identifying the zoos, and then gathering the general information and conservation information are described in detail below.

3.1.2.1 Identification of New Zealand Zoos

The first stage in compiling the database was to identify all of the zoos in New Zealand which met the research definition of a zoo. As explained in the introduction chapter, the definition of

a zoo for the purposes of this research is: 'An institution which houses a collection of primarily terrestrial wildlife and charges members of the public a fee in exchange for access to view the animals'. A variety of sources were used, including: travel and tourism websites (both for New Zealand as a whole and for particular regions); local government websites; a list of New Zealand zoos found on a zoo forum; and discussions with personal contacts.

Two zoos were excluded because they were out of operation at the time of the research. The Zion Wildlife Gardens in Whangarei was in receivership and liquidation, and the Southern Encounter Aquarium and Kiwi Encounter in Christchurch was inaccessible after the February 2011 earthquake and has since been demolished.

3.1.2.2 General information on New Zealand Zoos

As mentioned above, two types of information were collected for the database. The first of these was general information on each of the zoos, such as its history and type of ownership. The sequential nature of the research meant that as much potentially relevant information as possible was gathered, in order to allow for different variables that may allow zoos to be distinguished or grouped for the evaluation stage of the research.

The information entered into the database to meet Objective Two was:

- the full name of each zoo and its website,
- the location of the zoo,
- the history of the zoo,
- the type of ownership (such as public, private, or a charitable trust), and
- its visitor numbers.

Some of the information, such as the location of the zoo, was gathered for organisational purposes rather than for the purpose of the research outcome. Other information, such as the history, was gathered for informative purposes for other areas of the thesis, such as the introduction, the literature review, and the case studies.

It was intended that this information be found through media articles or publications in addition to each zoo's website and any reliable additional websites (such as regional tourism websites). However, there was very little relevant information found in the media. As such, the information found on each zoo was largely dependent on the quality of the information the zoo made available on its website. Seven small zoos did not have their own websites, and information on these zoos was obtained solely from secondary sources such as related but more generic tourism websites. However, the information found suggested that none of the zoos without websites held indigenous species, and so they were not relevant to the later stages of the research.

3.1.2.3 Conservation information for New Zealand Zoos

The second type of information gathered for the database was information on the conservation taking place at each of the zoos. In order to do this, criteria were selected which could be used to evaluate New Zealand zoos' contribution to conservation. Then, as with the general information, as much information as possible for each zoo relating to each criteria was found systematically. These two stages reflect the the two sub-objectives of Objective Three.

Selecting the criteria to be used was one of the stages of this research that was reliant on the literature review. Criteria were chosen according to the importance that was placed on them by authors collectively, and by their feasibility in applying them to zoos in New Zealand. The criteria selected were as follows:

- indigenous species kept in the zoo,
- forms of education that the zoo participates in,
- research that the zoo participates in,
- captive breeding,
- specialist facilities for captive breeding,
- releases into the wild of captive-bred individuals,
- in-situ programmes that the zoos is involved with,
- association memberships relating to conservation,
- accreditation relating to conservation,
- awards relating to conservation, and
- collaborations with other zoos or institutions.

As with the research on general information mentioned above, the zoos' websites were the primary source of information. Media articles and publications were also searched for relevant information, but again, they were found to contain little information relating to the research. Travel and tourism websites were useful in finding out which native species a zoo was holding (if any) if the zoo did not have a website.

The information found on each criteria for each zoo was entered into the database mentioned under Objective Two. This provided a comprehensive display of information and aided in the formation of an evaluation for zoos' contribution to conservation of indigenous species.

3.1.3 Evaluation

The next phase of the research was to develop a method of evaluating the contribution of New Zealand zoos to conservation of indigenous species. First, all of the zoos in the database were sorted so that only those with indigenous species remained. Next, the remaining ten criteria were condensed into six broader categories. This was achieved by combining similar categories, and had the benefit of making the criteria more manageable. Specialist captive

breeding facilities and releases into the wild were condensed into the captive breeding criteria. Conservation-related memberships, accreditation, and awards were combined into one criteria. The six new categories of criteria were:

- education that the zoo participates in;
- research that the zoo participates in;
- captive breeding, including specialist facilities and releases into the wild;
- in-situ conservation programmes the zoo is involved with;
- conservation-related memberships, accreditation, and awards; and
- conservation-related collaborations with other zoos or institutions.

Section 2.5 of the literature review discussed existing assessments of conservation in zoos. The greatest consensus of the authors was that conservation is difficult to measure and evaluate, and that evaluations tend to be subjective. Despite this, there were suggestions made by various authors that were able to be taken into account for this research. Usher (1986) noted that for conservation, evaluation tends to be comparative and involves value judgements. In order to reduce subjectivity, Usher (1986) suggested quantification and recommended a system with steps or stages. Wilkinson et al. (2011) used five criteria relevant to their conservation project in order to evaluate its conservation impact. However, the authors suggested that conservation action be measured rather than conservation impact, because measuring action is less subjective.

The evaluation method used for this research took the above comments into account. A system was devised so that the contribution to conservation of each zoo was evaluated six times, once against each of the six criteria described above. A stepwise scale from 0 to 4 was used in order to evaluate the extent to which the zoo contributed to the criteria, with 0 being no contribution at all, and 4 being a substantial contribution and the highest on the scale.

To ensure that each zoo was evaluated against the criteria in the same way, a series of general guidelines was developed to show what involvement was considered appropriate for each point on the scale. These guidelines took into account the range of different contributions zoos from around the country were involved with for each criteria. For example, the guidelines used for the education criteria are shown in Figure 3.1 on the following page.

0: No involvement in conservation-related education.
1: Only involved with tours for the public or schools, or with scheduled keeper talks.
2: A registered teacher is employed on site, and specific programmes are available for school groups to take part in.
3: Programmes for schools are customisable, and extra resources are available for teachers.
4: Some sort of additional education programme is offered, or there are combinations and extensions of the types of education mentioned above.

Figure 3.1: Guidelines for the Education criteria.

While not every zoo met these guidelines neatly, the guidelines provided an example of an acceptable level of involvement for each of the five numbers on the scale. This reduced subjectivity and meant that the zoos were evaluated fairly and consistently against the criteria.

3.2 Field-based research - zoo case studies

According to Moore (2006), combining research methods gives an added dimension to the research, and allows for the results to be enriched. More specifically, in the context of zoo research Frost (2011: 235) stated: "*There is value in taking a supply-side research approach, examining what zoos are doing and why. In taking that approach, there is further value in adopting comparative methodologies, contrasting zoos in different countries and those with differences in design, purpose, and scale*". The final stage of the research was to select three zoos from the completed evaluation of New Zealand zoos to examine further and discuss as case studies. Several staff members from each of the zoos (zoo practitioners) were interviewed, along with conservation practitioners working outside zoos. The methods used for this section were a series of semi-structured interviews.

3.2.1 Interview methods

Interviews are the most appropriate way to acquire qualitative, descriptive, and in-depth information of a complicated nature which is specific to the individual (Pickard, 2007). This accurately describes the case study section of this research, because the relevant information was qualitative and descriptive, and questions asked were more in-depth than could be answered with other methods such as a questionnaire. The information was also highly specific to each particular zoo, and also to the role of the interviewees within the zoo.

The interviewees were selected using a non-random, purposeful techinique, also known as purposive sampling (Blaxter, Hughes, and Tight, 2006; Boeije, 2010). In most cases at least one contact person was known at the zoo or department, either by word of mouth or by using the relevant website. From that contact person, a 'snowballing' method of recruiting

interviewees was used, where the initial contact person recommended further suitable practitioners to interview (Blaxter, Hughes, and Tight, 2006).

The answers sought from the interview were open-ended and relatively broad in scope, which, according to Burnett (2009), meant that a semi-structured interview format was the best suited. Semi-structured interviews are interviews with a standard list of questions, which also allow the interviewer to follow up on points of interest provided by the interviewees (Williamson, 2000).

Preparing an an interview guide with questions, keywords, or concepts to talk about is recommended by Dunn (2000) because it gives the advantage of being prepared for the interview while maintaining flexibility. The key themes used for the interviews are shown in the relevant sections below. Each theme had multiple questions to begin the topic with, and then more questions were asked during the interview to follow up on points raised by the interviewees. Examples of the interview guides are shown in Appendix C.

The interviews were recorded with a voice recorder (with the permission of the interviewees), and transcribed after the interview. Brief notes were also taken during the course of the interview to help direct thoughts and discussion during the interview, and also to serve as reminders for subsequent interviews.

After the interviews and transcripts were completed, the transcripts were analysed using a coding method. Coding is described by Boeije (2010: 94) as "*separating the data into meaningful parts*". The transcripts were coded by reading through the transcripts and identifying ideas that were repeated by multiple interviewees, which Auerbach & Silverstein (2003) described as 'themes'.

3.2.2 Interviews with zoo practitioners

The three zoos used as case studies were Auckland Zoo (AZ) in Auckland, and Orana Wildlife Park (OWP) and Willowbank Wildlife Reserve (WWR), which are both in Christchurch. In selecting these zoos, their differing strengths shown in the evaluation were taken into account along with the available time and budget, and the logistics of travelling to zoos. Three other zoos were approached before the above three were finalised, with the intention of giving a larger variety of case studies across the range of zoos, but they either did not respond or declined to give interviews. More details will be provided on the case study zoos and conservation practitioners in Chapters Four and Five.

The purpose of the interviews with the zoo practitioners was to gain more information on conservation activities taking place at the zoo, and to find out the practioners' perspectives on these activities and ways in which conservation could be improved at the zoo.

Four practitioners were interviewed at Willowbank Wildlife Reserve, and three each at Auckland Zoo and Orana Wildlife Park. The names and exact roles or job titles of the interviewees will not be given. However, Table 3.1 shows the general areas of the interviewees' positions in their zoos.

Table 3.1: Roles of interviewees at their respective zoos.

Willowbank Wildlife Reserve	**Auckland Zoo**	**Orana Wildlife Park**
Native species keeper (WWR1)	Education (AZ1)	Interpretation and promotion (OWR1)
Keeper (WWR2)	In-situ conservation (AZ2)	Native species keeper (OWR2)
Education (WWR3)	Native species keeper (AZ3)	Education (OWR3)
Promotion and education (WWR4)		

The following general themes were used as a guide for the zoo practitioner interviews:

1) Conservation activities currently being undertaken by the zoo.
2) Practitioner's perception of how effective the conservation activities are and their perception of what constitutes success.
3) Ways in which the zoo could improve its conservation activities.
4) Role of New Zealand zoos in conservation of indigenous species.

3.2.3 Interviews with conservation practitioners

The purpose of the interviews with conservation practitioners was to investigate the practitioners' perspectives on the general contribution of zoos in New Zealand to conservation of indigenous species. This allowed the perspectives of the zoo practitioners to be compared and contrasted with the perspectives of the conservation practitioners, in addition to the general consensus of the literature.

Three conservation practitioners from the Department of Conservation (DOC) were interviewed. Two were biodiversity co-ordinators, one based in Christchurch (DOC1) and the other in Auckland (DOC3). The third was also based in Auckland and was involved with community outreach for conservation (DOC2).

The following general themes were used to guide the conservation practitioner interviews:

1) Conservation activites currently taking place for indigenous species in New Zealand zoos (in general) and potential improvements that could be made.
2) Success of conservation activities for indigenous species in New Zealand zoos, and what constitutes this success or failure.
3) Zoos' roles in New Zealand conservation.

3.3 Limitations

While every effort was made to ensure the methods were as sound as possible, there were nonetheless some limitations. Due to time and budget constraints, information on each zoo for the database was collected on the internet. Internet-based sources do pose challenges in that the information is not verified and could be posted by anybody. Websites which were deemed to be reliable were used for the research. For example, some information was found in media or on secondary websites such as tourism websites. However, the source where most information was found was on each zoo's own website. Given that the information on zoos' websites is sourced directly from the zoos themselves, the websites can be considered as reliable as any other form of published material from the zoos.

With the zoos' websites being the primary source of information, the depth and quality of the information found was restricted to the amount of information each zoo decided to put on its website. It also assumed that if a zoo was doing something they perceived as beneficial for conservation, it would be mentioned on the website to attract visitors and appear favourable to the public. As mentioned earlier, seven small zoos had no website of their own and information was limited to information collected from secondary websites. However, no information about these zoos indicated that they held native species, and therefore they were not relevant to the remainder of the research.

The evaluation was also limited in terms of the information available. The evaluation used was well suited to the information available, but it is possible that with more information, other forms of evaluation might also have been investigated. However, due to time constraints and commercial sensitivity, it would not have been possible to gain quantified information on criteria such as inputs and outputs for conservation from each of the zoos with indigenous species. Despite this limitation, it is felt that the evaluation used was suited to the information available and supported by the literature, as discussed in section 3.3. In addition, the guidelines ensured that the evaluation was consistently applied to all of the zoos to minimise subjectivity.

Finally, there was a limitation on the amount of case study zoos that could be selected. While it would have been best for the research to interview staff at every zoo, there was not enough time or budget to allow for this. Instead, the case study zoos were selected taking into account both their location and how they could showcase the evaluation. Similarly, the number of conservation practitioners was limited. The practitioners were selected from the Department of Conservation because they are the governing authority most closely associated with New Zealand zoos. In addition, the DOC staff are familiar with the state of conservation as a whole in New Zealand and could comment on zoos' efforts as part of the 'big picture'. Accessibility was also a barrier to selecting interviewees from another conservation organisation also considered, in that the few members involved with zoos lived outside Christchurch and Auckland. However, interviewing conservation practitioners would be of benefit in future research. Organisations which would be useful to include are the Royal Forest and Bird Protection Society of New Zealand (Forest and Bird), and organisations focusing on the recovery of species, such as the Kiwi Recovery Group or the Kea Conservation Trust.

3.4 Summary

The research is sequential in nature, which ensures that the research takes existing knowledge into account, and that it is as relevant as possible to New Zealand indigenous species and zoos. Using a combination of desk-based and field-based methods has allowed this research more depth than if only one or the other had been used. The following chapter presents the results found using these methods.

Chapter 4
Results

The first part of this results chapter summarises the information gathered for the criteria used in the database. Following this is a detailed description of the evaluation stage of the research. The zoos to be used as case studies are identified from the evaluation and introduced. The chapter concludes with a presentation of the case studies and the results drawn from the interviews with zoo and conservation practitioners.

4.1 Database

A total of sixty New Zealand zoos met the research definition of a zoo. Of these, thirty-two held at least one indigenous species. The final version of the database shows only these thirty-two zoos, because the twenty-eight zoos with only exotic species were not relevant to this research. For the remainder of this thesis, the focus is on the thirty-two zoos with indigenous species.

Excluding the name and website of the zoo, the general criteria were not used in the final version of the database. As described in section 3.1.2.2 of the methods chapter, the location and history criteria were intended for purposes other than for the evaluation. Visitor numbers were discarded because only three zoos made visitor numbers available on the website or in publicly available reports. Therefore, it was not possible to differentiate zoos based on visitor numbers. Five different types of zoo ownership were identified. These are shown in Table 4.1.

Table 4.1: Types of zoo ownership.

Type of ownership	**Number of zoos with this ownership type**
Privately owned	11
Publicly owned	7
Non-profit organisations/registered charities	11
Company owned	2
Public-private partnership with DOC	1

The table shows that the most common types of ownership for New Zealand zoos are private ownership or non-profit organisations/registered charities. This was then followed by publicly owned zoos, which are the property of the local city or district council. However, the type of

ownership criteria was discarded from the final database because it was not possible to differentiate zoos for conservation based on their type of ownership. The remainder of section 4.1 describes each of the criteria used and the information found for these criteria. The database is shown in full in Appendix D.

4.1.1 Education

Twenty-five of the zoos were involved with at least one form of education. Some types of education were for the general public, while others were focused specifically on school groups. For the public, the most common forms of education were having guided tours of the zoo available (sometimes at an additional cost), and scheduled keeper talks (usually focused on a particular species). Some zoos provided detailed information on specific indigenous species on their websites. For example, Ti Point Reptile Park provided species-specific information on seven skinks (family Scincidae) and six geckos (*Hoplodactylus* sp. and *Naultinus* sp.), including photos and information on habitat and food. The website also showed differences between skinks and geckos, and included a note that all indigenous New Zealand lizards are protected by law and cannot be kept without a permit. Other zoos made educational games, resources, or advice available to the public. For example, Wingspan Birds of Prey has a children's activity page on the website, which (in October 2012) included raptor-themed recipes, a colouring competition, and a twenty question raptor quiz. Auckland Zoo provided tips on the website about ways for the public to protect the coastal environment and described other ways for the public to get involved, including instructions for attracting native birds into gardens and linking to the Department of Conservation (DOC) guide for making weta motels. School holiday programmes for children were common among the zoos, including junior keeper programmes for older children. A small number of zoos also offered work placement opportunities for high school students.

The form of education most commonly offered by zoos was group programmes, mostly for primary and secondary school groups. A number of these zoos also offered programmes for pre-school groups, tertiary students, community groups, or ESOL (English for Speakers of Other Languages) groups. Approximately half of the zoos employed their own qualified or registered teachers on site. In addition to teaching the children on site, some of the teachers visited the schools either before or after the school groups went to the zoo. Where zoos catered to groups, it was common for ready-made programmes and worksheets to be available. In addition, six of the zoos stated on their websites that they were able to customise the curriculum with the class teacher. Some of the zoos also made resources available to school teachers on their website, either publicly or after signing in.

4.1.2 Research

Only twelve of the zoos indicated that they were involved in some form of research related to indigenous species. Some of the websites stated that the zoos allowed university students and professionals to conduct research in the zoo, sometimes with collaboration from zoo staff. The external researchers included university students and professionals, from organisations such as the National Institute for Water and Atmospheric Research (NIWA) or universities. At Zealandia there were 17 external researchers in the 2010/2011 year, in addition to research being conducted by its own staff as part of the Karori Sanctuary Trust. Nga Manu Nature Reserve was another zoo which was supportive of external researchers and collaborative research. It also sponsors two research scholarships with Massey and Victoria universities for "*research that has relevance to the natural environment at Nga Manu*". Auckland Zoo, Wellington Zoo, and Willowbank Wildlife Reserve stated that research for native species is conducted in their on-site wildlife hospitals.

Five of the zoos gave specific examples of research that has been or is being conducted. Staff at Orana Wildlife Park conducted research on mohua (*Mohoua ochrocephala*) to assist DOC's in-situ efforts. Examples of research at Wellington Zoo's veterinary hospital included vaccinations for kakapo (*Strigops habroptila*) and respiratory research on kea (*Nestor notabilis)*, and Wellington Zoo staff were also working with the Wellington Greater Regional Council on developing kaka-proof (*Nestor meridionalis*) possum bait stations. Some of the research projects by Auckland Zoo staff were conducted outside the zoo, including ecosystem health maps of sanctuary islands in the Auckland area, and studying the health of kakariki (*Cyanoramphus* sp.) on Tiritiri Matangi Island in Auckland's Hauraki Gulf.

4.1.3 Captive breeding

Eighteen of the zoos were involved with captive breeding twenty-five indigenous species. The species mentioned on the zoos' websites are shown on the following page in Figure 4.1. As shown in Figure 4.1, the species bred by the most zoos is North Island brown kiwi (*Apteryx mantelli)*, which is bred in seven New Zealand zoos. Brown teal (*Anas chlorotis*) and tuatara (*Sphenodon* sp.) were each bred by six zoos, although the two tuatara species were combined because some zoos' websites did not name the species. Fifteen of the species were bred by only one New Zealand zoo.

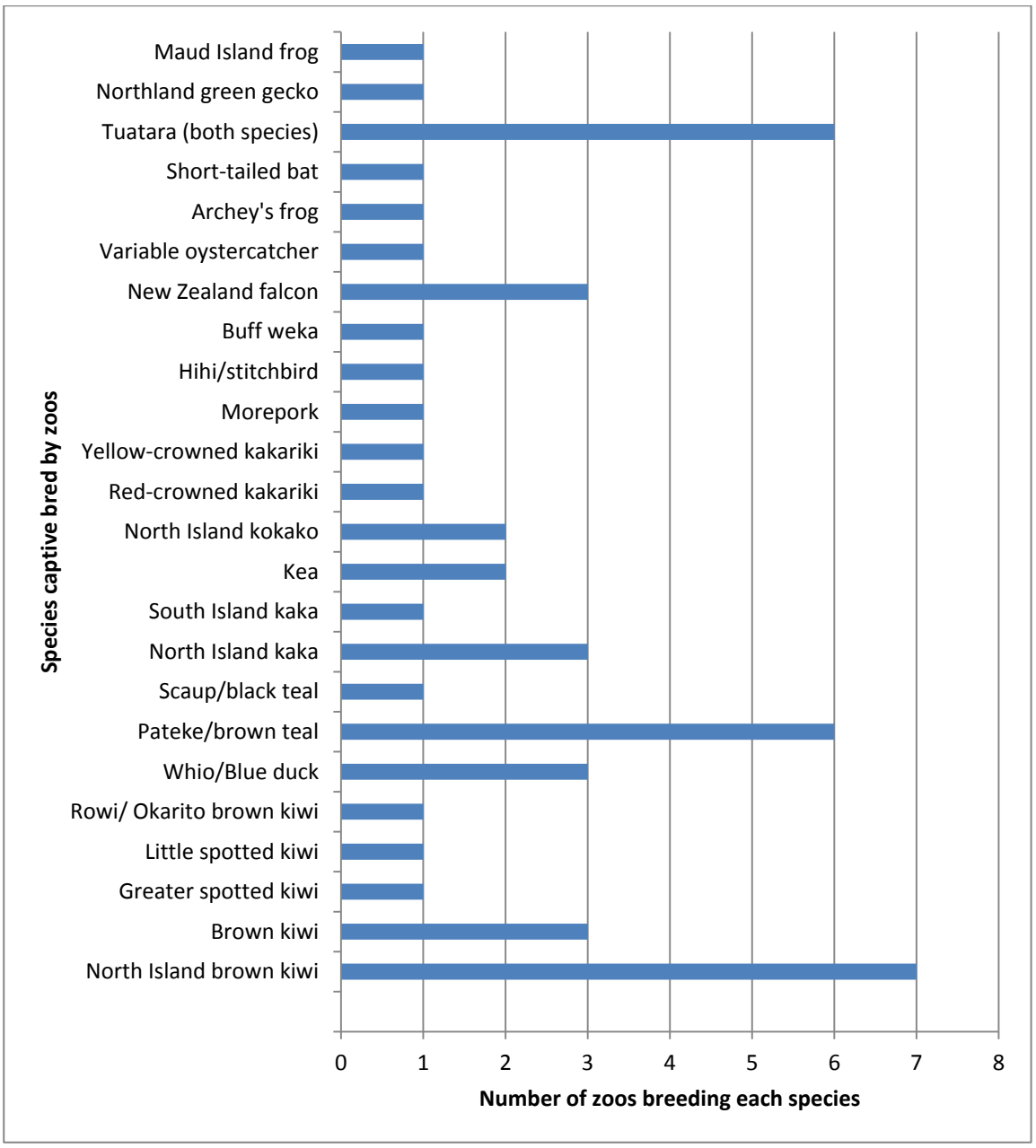

Figure 4.1: Number of New Zealand zoos breeding each indigenous species.

Some zoos have enabled breeding by providing a safe area or sanctuary where the animals are without threat, but the animals – especially in the case of flighted birds – are not in captivity. For example, the reserve at Pukaha Mt Bruce is 940 hectares, and aggressive pest control rather than a predator proof fence is used to make it safe for native animals. While some of the species at Pukaha Mt Bruce are kept in captivity, others are released into the forest reserve. The website gives the example of kaka in the forest: nine juveniles were released ten years ago, and the population has now reached 100 after uncontrolled breeding. Another example is the tuatara in Zealandia, which were released into the 225 hectares protected by predator-proof fences and have bred without being controlled.

4.1.4 Captive breeding facilities

Facilities intended solely for the purpose of captive breeding were mentioned on thirteen of the zoos' websites. For five zoos, their captive breeding facilities were in the form of having separate enclosures away from public view. Hamilton Zoo, for example, keeps one tuatara on display for advocacy purposes and all of the others off display for breeding. Willowbank Wildlife Reserve keeps its breeding kiwi off display, in a 2ha predator-proofed outdoor breeding area. While the adult geckos and tuatara are free-roaming inside Zealandia, the juveniles of the species are kept in enclosures for protection.

Other zoos mentioned facilities for incubation, hatching, and rearing native species. Veterinary hospitals mentioned on zoo websites also were involved with captive breeding of native species. This occurs either as part of the process, such as using incubation facilities that are part of the hospital, or in emergency situations, such as assisting in a difficult birth or hatching.

4.1.5 Releases into the wild

While eleven of the zoos had released individuals into the wild, only seven gave details. The individuals released were a combination of animals that had been bred, hatched, and raised in captivity (captive bred), and animals that had been hatched and raised in captivity after their eggs were taken from the wild (captive reared). Some of the zoos specified whether the animals had been captive bred or captive reared. However, in some cases it was unclear, so it was not possible to differentiate releases of captive bred animals from releases of captive reared animals. A total number of individuals for each species released from all zoos in New Zealand is shown in Table 4.2 below. Species included in this table not previously mentioned are: Rowi (kiwi; *Apteryx rowi)*; Southern brown kiwi *(Apteryx australis)*; Great spotted kiwi (*Apteryx haastii*); and stitchbird (*Notiomystis cincta*).

Table 4.2: Number of individuals released into the wild from New Zealand zoos.

Species	Number of individuals released
Kiwi (species unknown)	495
North Island brown kiwi	204
Brown teal/brown teal	156
Rowi (kiwi)	61
Tuatara (both species)	55
Southern brown kiwi	26
Great spotted kiwi	16
Kaka	8
Blue duck	Unknown
Kokako	Unknown
Stitchbird	Unknown

Table 4.2 specifically names four kiwi species that were released into the wild; however, many zoos did not state which species of kiwi they held or were releasing. This accounts for the additional 495 kiwis in the table whose species are unknown. As with Table 4.1, the tuatara species were combined because some zoos did not differentiate between species. The largest number of species released from a single zoo was from Rainbow Springs Kiwi Wildlife Park. The zoo's website stated that they had "*hatched, raised, and released 492 kiwi chicks since 1995*" (Rainbow Springs, 2011). With this example, the quoted wording made it clear that the individuals released had been captive reared rather than captive bred. Blue duck, kokako, and stitchbird were also released into the wild, although the zoos involved did not give details of the quantities released.

4.1.6 In-situ programmes

Twelve of the zoos had in-situ or outreach programmes that extended past the zoos' boundaries. Five of these zoos were involved with Operation Nest Egg (ONE). ONE is an initiative funded by the Bank of New Zealand (BNZ) and involves DOC, volunteers, iwi, researchers, and captive rearing facilities. Each breeding season, kiwi eggs and chicks are taken from the wild to be hatched and reared in captivity, before being released to protected crèche sites and then back into the wild. As part of Operation Nest Egg, over two hundred kiwi chicks are reared each year in captive facilities across New Zealand (Operation Nest Egg, 2012).

The zoos with wildlife hospitals assisted the recovery of injured native animals in addition to caring for the animals within the zoo. Zoos also participated in a variety of local programmes and initiatives. For example, staff at Zealandia are involved with the Wellington Green Forum, and staff at Wingspan Birds of Prey collect reports of New Zealand falcon ((*Falco novaeseelandiae)* sightings to put into a national database. The International Antarctic Centre sponsors the white-flippered penguin (*Eudyptula minor albosignata)* conservation programme started by pupils of Le Bons Bay School. Auckland Zoo operates Urban Ark (a pest control programme) in the vicinity of the zoo.

Several zoos also described their sustainable or 'environmentally-friendly' practices on their website. While these practices take place inside the zoo, they are perhaps most closely linked to in-situ conservation in that their purpose is reducing impact on the environment. The practices included waste reduction, recycling, composting, rainwater collection, energy and water reduction, greywater recycling, and using solar panels. For example, Pukaha Mt Bruce has waste management and recycling programmes in place, practices energy efficiency where possible, and collects water from the roof of the visitor centre. Along with recycling, reducing

waste, and reducing adverse effects of resource use, Paradise Valley Springs Wildlife Park states that it ensures that run-off from the property does not enter waterways.

4.1.7 Association memberships

The World Association of Zoos and Aquariums (WAZA) and the Australasian regional association Zoo and Aquarium Association (ZAA) were mentioned in Chapter Two. Sixteen of the zoos were members of ZAA. Of these, three zoos also belonged to WAZA.

The only other association mentioned was the International Species Information System (ISIS), of which five zoos were members. All of these five zoos were members of the ZAA, and two (Auckland Zoo and Orana Wildlife Park) were also members of WAZA.

4.1.8 Accreditation

There were no accreditation systems mentioned by the zoos that related specifically to conservation. However, there were two types of accreditation related to sustainable practices. Qualmark describes itself as "*New Zealand tourism's official quality assurance organisation*" (Qualmark, 2012). In addition to its quality ratings, Qualmark offers 'Qualmark Enviro' accreditation for tourism businesses wanting recognition for sustainable practices. Six zoos in total had achieved Qualmark Enviro accreditation. The National Aquarium of New Zealand achieved Enviro Silver, described as "*meets high levels of environmental and social responsibility*" by Qualmark (2012). Auckland Zoo, Paradise Valley Springs Wildlife Park, Rainbow Springs Kiwi Wildlife Park, Te Puia Kiwi House, and Wellington Zoo all achieved Enviro Gold, which is described by Qualmark as "*exceeds the highest levels of environmental and social responsibility*" (2012).

The other accreditation mentioned was ISO14001, which has been achieved by Auckland Zoo in addition to their Qualmark Enviro Gold. ISO14001 "*applies to those environmental aspects that the organization identifies as those which it can control and those which it can influence*" (International Organisation for Standardisation (ISO), 2012), and helps the organisation to establish and improve an environmental management system.

4.1.9 Awards

Five of the zoos mentioned conservation or environmental awards they had received. These are shown in Table 4.3 on the following page.

Table 4.3: Conservation and environmental awards received by zoos.

Zoo	Award
Auckland Zoo	2005 Conservation Achievement Award in Partnerships and Community Involvement. 2005 ARAZPA In-Situ Conservation Award.
Kiwi Birdlife Park	Gibbs Wildlife Conservancy Excellence Award for the Most Innovative Wildlife Display, awarded for the Campbell Island teal (*Anas nesiotis*) enclosure.
Wellington Zoo	Winner of two 2009 Sustainable Business awards.
Wingspan Birds of Prey	Department of Conservation 2004 Contribution to Conservation by a Group.
Zealandia	2010/2011 - Virgin Holidays Responsible Tourism: Best for Conservation of Wildlife and Habitats.

Table 4.3 shows that the awards vary greatly. Some are awarded from within the industry, such as from the Department of Conservation or ARAZPA (now known as ZAA). Other awards were not targeted at zoos specifically, such as the Virgin Holidays Responsible Tourism award or the Sustainable Business awards. The awards were given for a variety of reasons, including conservation, contribution to conservation, most innovative wildlife display, and partnerships and community involvement.

4.1.10 Collaborations

New Zealand zoos holding native species require permission from the Department of Conservation. Thirteen of the zoos mentioned DOC on their websites. Some zoos gave a statement referring to DOC's role with indigenous species, for example: "*as an endangered species, the kiwi at Willowbank Wildlife Reserve come under the governance of the Department of Conservation*" (Willowbank Wildlife Reserve, 2012). Other zoos stated that they were further involved with DOC beyond the requirement to obtain permission. Examples of this include the Kiwi Birdlife Park working with DOC to release captive-bred birds, or Staglands consulting with DOC about captive breeding. Pukaha Mt Bruce also collaborates with DOC on species management, forest regeneration, and pest control inside its 942 hectare forest reserve.

In addition to collaborations with DOC, zoos referred to collaborations with a variety of different organisations. These included universities and research institutions, councils, government agencies, community organisations, and iwi. The organisations are shown in Table 4.4 on the following page.

Table 4.4: Institutions, agencies, and organisations collaborating with zoos.

Universities	Government-related agencies/organisations	Public organisations and community groups	Local iwi
Victoria University	Auckland Regional Council	Forest and Bird	Ngati Whatua o Orakei
Canterbury University	Ministry of Fisheries	Otago Natural History Trust	Ngati Kahungunu
Massey University	Hawkes Bay Regional Council	Otago Museum	Kati Huirapa Runaka ki Puketeraki
University of Otago	National Institute of Water and Atmospheric Research (NIWA)	Raptor Association of New Zealand	Te Ati Awa
	Landcare Research	Zoological Society of Auckland	
	Department of Conservation	Natural History New Zealand	

The table shows a range of organisations which collaborate with zoos. Some of these are local or regional, including the iwi, local government, and organisations such as the Otago Natural History Trust or the Zoological Society of Auckland. Others are nationwide organisations, such as the Ministry of Fisheries, NIWA, Forest and Bird, and the Raptor Association of New Zealand.

4.2 Evaluation

As discussed in Chapter Three, an evaluation was developed using the information collected in the database. The ten criteria described in section 4.1 of this chapter were condensed into six criteria:

- Education;
- Research;
- Captive breeding;
- In-situ conservation;
- Memberships, accreditation, and awards;
- Collaboration.

The Education, Research, In-situ conservation, and Collaboration criteria remain the same. The Captive breeding criteria consolidates the information found for captive breeding facilities and releases into the wild with the information found for captive breeding. The memberships, accreditation, and awards criteria were combined into one criteria because each of them did not have enough individually to set apart zoos. In addition, the three are similar in that they relate to industry recognition of the zoos.

The zoos were evaluated on each of the six criteria, using a stepwise scale of 0 (no contribution) to 4 (the highest contribution on the scale). It is important to note that the

evaluation is based on the information available on zoos' websites and not as a result of visits to the zoos. As such, the information is reliant on websites being up to date and accurate.

As described in Chapter Three, guidelines were developed for each of the criteria to ensure that the evaluation was as fair and unbiased as possible. Figure 3.1 in Chapter Three shows the guidelines used for the Education criteria. The subsequent evaluation of the Education criteria using the guidelines is shown as an example in Table 4.5.

Table 4.5: Evaluation of the Education criteria.

Education	Action taken (0=none, 4=highest)				
	0	1	2	3	4
Auckland Zoo					✓
Brooklands Zoo		✓			
Dunedin Botanic Garden	✓				
Franklin Zoo & Wildlife Park					✓
Hamilton Zoological Gardens				✓	
International Antarctic Centre				✓	
Katikati Bird Gardens	✓				
Kiwi Birdlife Park		✓			
Kiwi North			✓		
Maple Glen	✓				
National Aquarium of New Zealand			✓		
Natureland Zoo				✓	
Nga Manu Nature Reserve				✓	
Orana Wildlife Park			✓		
Otorohanga Kiwi House				✓	
Owlcatraz	✓				
Paradise Valley Springs Wildlife Park	✓				
Pukaha Mt Bruce National Wildlife Centre		✓			
Rainbow Springs Kiwi Wildlife Park				✓	
Reikorangi Pottery and Animal Park	✓				
Southland Museum			✓		
Staglands		✓			
Te Anau Wildlife Centre	✓				
Te Puia Kiwi House		✓			
The National Kiwi Centre		✓			
The Parrot Place	✓				
Ti Point Reptile Park				✓	
Wellington Zoo					✓
West Coast Wildlife Centre			✓		
Willowbank Wildlife Reserve					✓
Wingspan Birds of Prey		✓			
Zealandia					✓

The remaining five criteria were evaluated in the same way with their own set of guidelines. All six evaluations are shown together with their guidelines in Appendix E. One final evaluation comprising all six of the evaluations was created to show each zoo's contribution as a whole across the criteria. This final evaluation is shown in Table 4.6.

Table 4.6: Final evaluation combining the six individual criteria.

Zoo	Education	Research	Captive Breeding	In-situ	Memberships	Collaborations
Auckland Zoo	4	4	4	4	4	4
Brooklands Zoo	1	0	0	0	3	0
Dunedin Botanic Garden	0	0	3	0	3	2
Franklin Zoo & Wildlife Park	4	0	0	0	0	0
Hamilton Zoological Gardens	3	0	4	0	3	2
International Antarctic Centre	3	0	0	1	2	0
Katikati Bird Gardens	0	0	0	0	0	0
Kiwi Birdlife Park	1	2	4	2	3	1
Kiwi North	2	0	0	0	2	4
Maple Glen	0	0	0	0	0	0
National Aquarium of New Zealand	2	1	0	3	3	4
Natureland Zoo	3	0	0	0	3	0
Nga Manu Nature Reserve	3	3	1	0	2	3
Orana Wildlife Park	2	3	4	1	3	0
Otorohanga Kiwi House	3	0	4	0	2	0
Owlcatraz	0	0	1	0	0	0
Paradise Valley Springs Wildlife Park	0	0	0	1	4	0
Pukaha Mt Bruce National Wildlife Centre	1	0	4	2	2	1
Rainbow Springs Kiwi Wildlife Park	3	3	4	2	4	0
Reikorangi Pottery and Animal Park	0	0	0	0	0	0
Southland Museum	2	0	1	0	0	0
Staglands	1	0	2	0	0	1
Te Anau Wildlife Centre	0	0	0	0	0	1
Te Puia Kiwi House	1	0	2	0	3	0
The National Kiwi Centre	1	1	0	0	0	2
The Parrot Place	0	0	0	0	0	0
Ti Point Reptile Park	3	0	0	0	2	0
Wellington Zoo	4	4	4	4	4	4
West Coast Wildlife Centre	2	0	4	2	0	1
Willowbank Wildlife Reserve	4	4	4	3	0	1
Wingspan Birds of Prey	1	2	2	2	1	2
Zealandia	4	3	3	4	1	4

The average score for each of the criteria is displayed in Table 4.7.

Table 4.7: Average score for each criteria.

Criteria	Education	Research	Captive breeding	In-situ	Memberships	Collaboration
Average	1.84	0.94	1.72	0.97	1.69	1.16

Table 4.7 shows that the criteria with the highest average score was education, with an average of 1.84 over the 32 zoos. Captive breeding (1.72) and Memberships, associations, and awards (1.69) were the next highest. Collaboration (1.16) was in the medium range, and In-situ conservation (0.97) and Research (0.94) had the lowest average score. Figure 4.2 shows the range of average scores below.

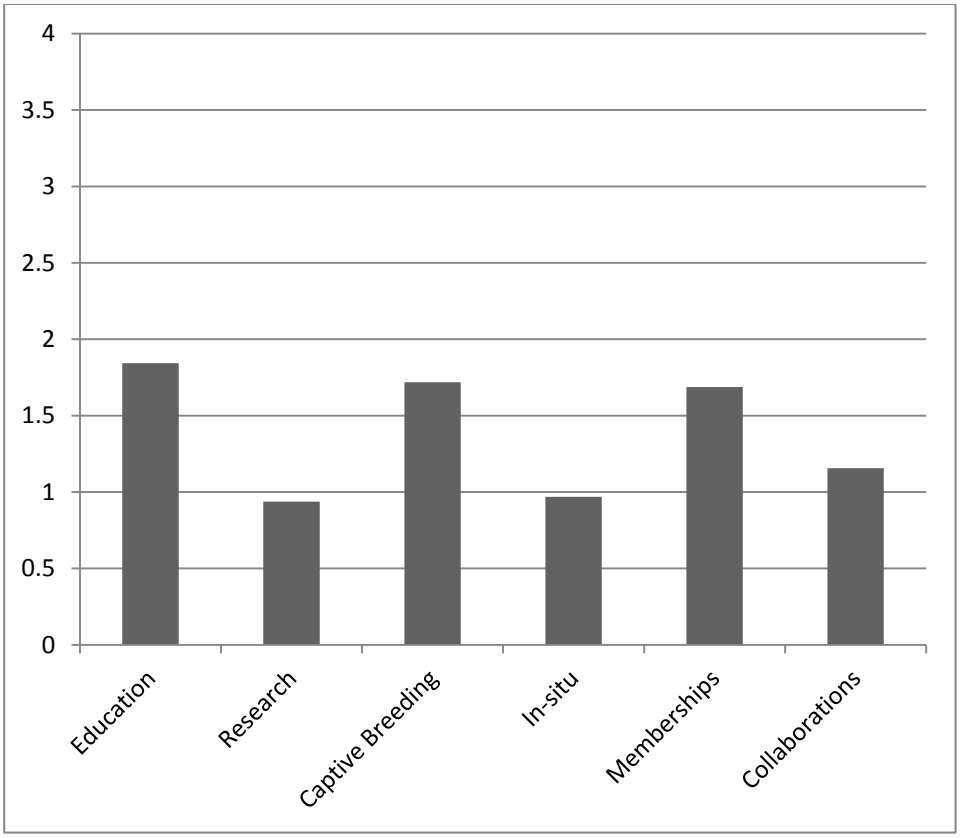

Figure 4.2: Average score for each criteria.

The graph shows that the average scores for Education, Captive breeding, and Memberships are significantly higher than the scores for the other criteria. However, all of the average scores are below 2 from a highest possible score of 4, which shows that on the whole, zoos still have room to improve their conservation efforts.

4.3 Identification of Case Studies

After the evaluation was completed, three zoos which would be appropriate as case studies were identified. The purpose of the case studies was to add context to the evaluation and

examine zoos' contributions to conservation in relation to the criteria. As described in Chapter Three, the intention was to obtain a cross-section of zoos and showcase differing strengths, but timeliness and geographic proximity were also important factors in selecting the case study zoos. The three zoos chosen were Auckland Zoo (AZ), Orana Wildlife Park (OWP), and Willowbank Wildlife Reserve (WWR). The combined evaluation for these three zoos is shown in Table 4.8:

Table 4.8: Combined evaluations for Auckland Zoo, Orana Wildlife Park, and Willowbank Wildlife Reserve.

Zoo	Education	Research	Captive Breeding	In-situ	Memberships	Collaborations
Auckland Zoo	4	4	4	4	4	4
Orana Wildlife Park	2	3	4	1	3	0
Willowbank Wildlife Reserve	4	4	4	3	0	1

Figure 4.3 shows the major cities and towns of New Zealand. Auckland Zoo is located in Auckland, in the upper North Island. Orana Wildlife Park and Willowbank Wildlife Reserve are both located in Christchurch, on the east coast of the South Island.

Figure 4.3: Map of New Zealand showing cities and towns. Obtained from: http://upload.wikimedia.org/wikipedia/commons/1/1a/New_Zealand_map.PNG

Interviews were conducted with a total of ten practitioners at the three case study zoos, and three conservation practitioners from the Department of Conservation. Example sets of interview questions are shown in Appendix C.

4.3.1 Auckland Zoo

Based on visitors per year (710,000 in 2011/2012), Auckland Zoo is the largest of New Zealand's zoos (Auckland Council, 2012). It began as a private menagerie in 1911 and was bought by Auckland City Council in 1922. Upon this sale, the zoo relocated from Onehunga to its current 17ha site in Western Springs. Today the zoo has the largest collection in New Zealand with over 860 animals from 138 species (Auckland Council, 2012). Te Wao Nui, a precinct for New Zealand species, opened in September 2011 and incorporated the pre-existing New Zealand exhibits. Te Wao Nui is divided into six separate exhibits, each representing a habitat: The Coast, The Islands, The Wetlands, The Night, The Forest, and The High Country. Figure 4.4 shows a kea beside interpretation in The High Country.

Figure 4.4: A kea walks above interpretation in Auckland Zoo's 'The High Country' exhibit. Photo: Lauren Maciaszek.

4.3.2 Orana Wildlife Park

Orana Wildlife Park (Orana Park) opened in 1976 and is situated on 80ha to the north-west of Christchurch. It is operated by Orana Wildlife Trust, a registered charitable trust, which also operates the Natureland Zoo in Nelson (Orana Wildlife Trust, 2003). In 2010, the zoo's annual attendance was 160,000 (International Zoo Yearbook, 2011). Sixteen animal feeds accompanied by keeper presentations are scheduled every day. These include a talk on New Zealand birds and kea, and a talk for kiwi. The area for New Zealand species comprises the

kiwi house, kea aviary, reptile house, and separate aviaries for a range of species. Interpretation in the kea exhibit at Orana Park is shown in Figure 4.5.

Figure 4.5: Interpretation at Orana Park showing how visitors can change their actions to benefit kea. Photo: Lauren Maciaszek.

4.3.3 Willowbank Wildlife Reserve

Willowbank Wildlife Reserve (Willowbank) was established in 1974 and is located on 18ha on the northern outskirts of Christchurch. Although the reserve is privately owned, the owners and staff work alongside the New Zealand Conservation Trust (NZCT). Willowbank is divided into three distinct areas: Wild New Zealand (includes pukeko (*Porphyrio porphyrio*), and various indigenous species of eels and ducks, along with exotic animals such as otters and primates); Heritage New Zealand (primarily farm animals); and Wild New Zealand (primarily indigenous species, including kiwi, tuatara, and kea). Figure 4.3 on the following page shows a tuatara at Willowbank.

Figure 4.6: Tuatara at Willowbank Wildlife Reserve. Photo: Lauren Maciaszek.

4.4 Case studies

This section of the results chapter discusses the three case study zoos in detail. It is divided into themes identified in the interviews with zoo and conservation practitioners.

4.4.1 Organised education

Education was one of the key components of zoos' contributions to indigenous species conservation. The types of education at the three zoos varied, but all three zoos provide both formal education (organised programmes, primarily for school groups) and informal education. The remainder of this section focuses on organised education, in the form of programmes for groups and keeper talks. Informal education is then discussed in the following sections on Interpretation and Advocacy.

As part of their formal education programme, Willowbank staff visit schools before the students visit the zoo. "*We prefer to have that connection with them first in the classroom and then bring them out rather than the other way around because it falls to pieces a bit when they come here because it's so exciting*" (WWR3). According to WWR3, the talks to school children discuss the threats to the species being discussed and what is happening with the recovery: *"not only do we do the recovery side of it but we try and follow it up by focusing on the education side as well*" (WWR3). The staff also take a tuatara to classroom talks to make the information more relatable to the students.

The preference for education at Auckland Zoo is to teach at a habitat level rather than focus on individual species. "*We often will teach now in Te Wao Nui, and that often is teaching the habitat approach*" (AZ1). By doing so, students learn about the ecosystem as a whole rather than learning about species in isolation. There is also a strong focus on encouraging children

to become involved with conservation in their gardens and school grounds. The zoo has adapted its Urban Ark programme (pest and predator control in the zoo grounds) for use in schools. Students are involved with invertebrate monitoring and bird counts to identify what species are present in the school grounds. They then develop pest control programmes and create new native habitats for indigenous birds and invertebrates, such as the New Zealand mantis (*Orthodera novaezealandiae*): "*they're a really really good example of a species that an 8 year old can do something about*" (AZ1).

In addition to their formal education for schools, Auckland Zoo has increased the amount of staff available in the newly-opened Te Wao Nui to speak to the public: "*we do customer surveys to see what people like, and as an outcome of that, with Te Wao Nui, we've staffed it, and we're really trying to get a lot of face time – so the staff talking to the visitors. We know that tends to be effective, as opposed to the signage*" (AZ1).

Similarly, Orana Park has a daily animal feeding programme in which staff engage with and educate the public about the species. It is the education for schools, however, that staff put the emphasis on: "*once you've got somebody hooked into conservation, they're always going to be into it, they're always going to be interested. So for us, getting those wee kids like for zoo school, it's really cool because you can get them so enthused about a tuatara or a kiwi or something and you know they're going to carry that through*" (OWP2).

One trend noted among the practitioners was that they can be constrained by the curriculum in terms of what they can teach. "*Our first obligation is to curriculum, which in New Zealand contains no requirement for any kind of environmental education or any kind of conservation or sustainability message*" (OWP3). Therefore, the zoos need to fit their educational messages in with each teacher's requirements. "*There are also restrictions in following the school curriculum because schools are so tied up and teachers are so busy you have to be able to give them a package to fit in with what they're doing, because they haven't got the time to adapt what you've got into their curriculum. So if you want them to include your information you have to give it to them on a plate*" (DOC3).

According to AZ1, teachers will ask for a lesson that focuses on an individual species, such as kiwi, kea, or skinks, despite Auckland Zoo's preferred habitat approach to education. Schools visit the zoos for a range of subjects: "*the teachers come to us with a particular curriculum area that they want to deliver on and that can be anything from Health and PE with healthy eating stuff through to Chemistry, physical phenomena…the living world biology is our core though and within those it's easy to fit conservation messages*" (OWP3). Auckland Zoo also

reported a range of subjects, including Year 12 ecology students visiting the zoo specifically to study indigenous plant species.

In addition to organised education as discussed above, visitors to the zoo can absorb educational messages from the interpretation displayed in the zoo.

4.4.2 Interpretation

The interpretation in the zoo grounds was another form of education that practitioners at the zoos emphasised. All of the case study zoos have been recently involved with updating their interpretation. Auckland Zoo developed new interpretation for the 2011 opening of the New Zealand Te Wao Nui precinct. Orana Park recently finished replacing interpretation around the park, and Willowbank is currently in the midst of replacing their interpretation. The zoos recognised that they needed to engage the attention of their visitors and focus on delivering messages efficiently: "*they were previously white on black text with an image and screeds of writing. They were really trying to inform people, but they were missing the engagement and the connection that really motivates people to engage in those actions*" (OWP3). WWR1 agreed that the interpretation needs to look interesting and engage visitors: "*that's something we've been trying to work towards – changing the signage from just having species information to having fun stuff around for both age groups* [children and adults]" (WWR1).

Orana Park is beginning a new initiative in which QR (Quick Response) codes are attached to the signs around the park (see Figure 4.7 on the following page). The codes can be scanned by a smartphone and allow access to information on the website which cannot be accessed by any other method. According to OWP3, the information is aimed at increasing visitors' connections with the animals. In addition to more information on the species, information on the individuals in the exhibit is given too: "*so they're no longer just a group, they've got names, they're individuals. Birthdays are a great one, because the kids will identify with that – I'm older than that, I'm younger than that, we've got the same birthday… these sort of things build that connection. And it's tied in – immediately under that information comes the action to address the main driver of their threatened status*" (OWP3).

Figure 4.7: The QR code is visible in the top right corner of Orana Park's blue duck exhibit. To the right is a closer view of the QR code. Photo: Lauren Maciaszek.

All three of the zoos use interpretation as a way to educate the public about the threats faced by the species: "*we're really adamant that if we are raising an issue…there has to be a tangible, achievable action for the public to take. Otherwise, we're saying 'Hey, this is a problem, feel bad about it', and that's a really disempowering, disconnecting message*" (AZ1). Both Auckland Zoo and Orana Park chose to focus on a few key types of messages. Orana Park focused on six different conservation-related areas, including water quality, habitat loss, and responsible pet ownership. Each of the areas has specific actions relating to it. Examples of actions for responsible pet ownership are 'keep dogs on a leash' or 'put bells on cats'. One such conservation action appears on the interpretation for each species, including some of the exotic species. Figure 4.8 shows the conservation action 'wash your car on the grass' on the otter interpretation at Orana Park. The conservation actions are also integrated into formal education and keeper presentations.

Figure 4.8: Conservation action benefiting indigenous species on the otter interpretation at Orana Wildlife Park. Photo: Lauren Maciaszek.

Auckland Zoo chose to focus on key phrases of engagement and action in order to appeal to different types of audiences: "*'get involved', 'protect', 'choose', and 'live sustainably', and those headings cover a range of activities. So 'live sustainably' are things that people might do at home and never really tell anyone else about, but they'll recycle and they'll walk to work…it's their domestic activity. 'Choose' is more about purchasing. 'Get involved' is when they go beyond their home, so they take part in a community thing or they sign a petition*" (AZ1). Some of these phrases and associated conservation actions are shown below in Figure 4.9.

Figure 4.9: Interpretation showing conservation phrases and actions at Auckland Zoo. Photo: Lauren Maciaszek.

The process of developing interpretation demonstrated collaboration between the zoos and other organisations. For example, Auckland Zoo consulted with local iwi, particularly Ngati Whatua, and DOC on the content of their interpretation. "*We just basically went over it to make sure the facts were right, and the information they brought forward was spot on. They're really professional with this sort of thing, so it was just a case of us working with them to make sure that we had everything covered. They were happy to take on board whatever we had to offer them*" (DOC2).

Orana Park consulted with DOC on their interpretation when the new kea aviary was developed: "*if we're looking at native species we make sure that the messages we're getting across are the same ones that DOC want put out*" (OWP1). Orana Park also employed research obtained through their ZAA connections to make the new interpretation as effective as possible for advocacy purposes.

4.4.3 Advocacy

Part of the requirements for zoos holding indigenous species is that they have an advocacy plan: "*that plan provides some sort of idea about what the conservation benefit is of having that species in captivity. They've got to provide messages to the public and all that sort of thing, so they become more responsible in actually providing a lot more information*" (DOC1). The information from the interviews indicated that zoos have moved away from educating only about the species; now, their messages include the threats the species face and shows zoo visitors what they can do to help. "*It's all very well to be doing these recovery programmes, but unless you can actually educate people as to why we have to do these programmes and for how long we can foreseeably see them being done, you haven't really completed the circle*" (WWR3). Staff at all three zoos and DOC emphasised the importance of encouraging visitors to make changes to their lives and influencing others to do the same. "*What we can really do is try and educate people. Try and get them to make smarter choices day to day, and get involved themselves, and contribute in whatever way they can*" (AZ3). OWP1 supported encouraging visitors to change their lifestyles: "*what we're really trying to show people is that conservation is everyone's responsibility and it can start on your own doorstep. It's not just about giving money to someone else and they do the work, it might be things like consider what you purchase*" (OWP1). The opinion expressed by DOC2 closely matches that in the above quote from OWP1: "*we've got to make people understand that throwing money at a problem is not going to resolve it. It has to come from the ground roots up. It has to come from peoples' perspectives and their way of life*" (DOC2).

The zoo practitioners used their experience with the animals to make their advocacy messages better relate to visitors. According to WWR3, this is the reason for all of the keepers at Willowbank being required to give presentations: "*we know so much about them anyway because we're working with them, so it's best to share that information. We'll have a ground roots explanation of it that we can share with people*" (WWR3).

As part of the interpretation in Te Wao Nui, Auckland Zoo used some of DOC's old signs from conservation parks and ranger huts. "*They're very keen on telling our stories - the DOC rangers' stories – as part of the interpretation. One of the benefits of them coming out and helping us with projects is that they own those stories too; they're a part of those projects. That advocacy is really important because it helps put conservation into the minds of people who are taxpayers, and they're voting on whether or not money goes into conservation*" (DOC3). Staff at Auckland Zoo also saw the value in sharing their in-situ experiences: "*getting [staff] out into the field so that they can talk with personal experience about*

conservation issues...just going out and being present when we're releasing tuatara back into the wild, and the staff can come back and talk about it with a lot of passion and also personal experience" (AZ3).

Many of the practitioners, both from the zoos and from DOC, saw the individuals held in zoos as advocates for their species' conservation: "*for a large number of species in our collection, their main role is the communication of conservation messages*" (AZ1). One of the main reasons for this is that New Zealand's indigenous species (especially the most vulnerable) are found in areas that most people do not have easy access to. "*For example, the tuatara are found on offshore islands or mainland predator-free islands like Karori Sanctuary in Wellington. So the chances of you or I as a New Zealander being able to see one of our key iconic species is in places like Orana Wildlife Park*" (OWP1). This reasoning was supported by the DOC practitioners: *"[Auckland Zoo are] hoping to get kakapo* [Strigops habroptila] *and takahe* [Porphyrio hochstetteri]*...It would be great from our perspective for them to have those species, because it's difficult for people to go off to Codfish Island and see the kakapo*." (DOC2). Takahe are another indigenous species difficult to access in their natural habitat. Figure 4.10 below shows one of the takahe held for advocacy at Willowbank.

Figure 4.10: Takahe held for advocacy purposes at Willowbank Wildlife Reserve. Photo: Lauren Maciaszek.

An example of one bird being used as an advocate for its species was observed at Auckland Zoo. A kaka had been shot on Great Barrier Island and was taken to the New Zealand Centre for Conservation Medicine (NZCCM) at Auckland Zoo for medical attention. Visitors to the zoo could observe the operation taking place through the glass windows to the operating room. Staff from the NZCCM and zoo spoke to the public about the procedures and using the opportunity to advocate for the species. In addition, a news camera crew were filming the

operation and speaking to staff so that the messages could be spread around the country. In our subsequent interview, AZ3 agreed that the opportunity for advocacy was valuable: "*so you would've seen with the kaka, we helped that bird as an individual, but we also used the opportunity to get messages out there, so there was a lot of media involved. We were trying to make sure the visitors got to learn about it, but also the wider community. We need to make sure we minimise human conflict, so if people are shooting them, we need to try and advocate to change that behaviour*" (AZ3).

OWP1 described advocacy and the chance to see the animals as "*one key role*" of the zoo. Other zoo practitioners placed further importance on advocacy and described it as the main role of their zoo: "*we can play our role as an advocate, which is our key role, and connect the visitors to wildlife and make them care, and perhaps change behaviour to benefit wildlife. And that's our whole role…*" (AZ2). OWP2 also commented on advocacy being a central role of the zoo: "*we see ourselves as very much a way to get people enthused and interested in the species so that they are taking it with them when they leave, and then they'll have more of an interest in their own backyards*" (OWP2).

The interviewees from DOC agreed with the assertion from the zoos that advocacy is one of zoos' main roles: "*I see zoos' role as being more as advocacy, informing people. People only really start caring for something if they can understand it – if they can see it, touch it, that kind of thing. That's the best way to gain empathy for people, and until they have that empathy they're not going to have any input*" (DOC2). This interviewee went on to describe zoos as "*the interface between what's going on and the general public perception; it's a way of breaching that gap... they're in a unique position to bring that message home to people*." (DOC2). Interestingly enough, DOC2 also noted that while the zoos might see advocacy as their main role, the visitors to zoos go for entertainment rather than education: "*speak to anyone, and they generally go to the zoo for a family day out, entertainment, to enjoy. It's not to be bombarded with messages about the things we're doing wrong, they're going for a day with the kids, and we've got to ride on the back of that and get the message through in a positive way*" (DOC2).

4.4.4 Research

Research is another of the criteria used for the evaluation, and the information gathered showed that research was conducted in New Zealand zoos. "*At the end of the day, it's the other thing that zoos are really good for, it's captive collections of animals that you can try things out on to make sure they'll work on the wild animals as well*" (WWR1). Despite this quote, the interviews showed that the zoos do not actively set out to do their own research.

Instead, several practitioners mentioned that they are willing to conduct research for others, or to allow others to conduct research themselves: "*it's more that people come to us and usually we're happy to be involved in research so long as it's not detrimental to the animals*" (WWR1). Staff at Orana Park expressed a similar viewpoint on conducting research: "*we don't drive it too much, but having the animals here, we are very, very willing – providing it passes ethics approval and DOC approval – to use the animals that are here for research*" (OWP3). DOC3 stated that Auckland Zoo had also conducted research on behalf of DOC and added that "*having a captive population means that it's easier to manipulate what's going on and try different diets or different treatments for diseases and different things*" (DOC3).

In addition to allowing research to take place, observations were also made in the zoos as part of routine work or changes in a programme that led to new knowledge. AZ3 used the Archey's frog (*Leiopelma archeyi*) breeding programme as an example. The keepers could not tell the males apart from the females when the programme started. Now that the staff can distinguish between the genders, they are investigating triggers to stimulate breeding.

According to WWR1, research published in scientific papers is not relevant to the practical husbandry in the zoo. Instead, new research is exchanged amongst the zoo community. For example, WWR3 stated that there is a meeting each year, in which "*all kiwi people get together and have a good old discussion and we can share that information at that time*" (WWR3). The same method is used for implementing new research: "*we have a discussion with all the involved parties together. We have to be quite definite on why we're doing it and what we want to do and how we're going to achieve it, because there's no point in it otherwise*" (WWR3).

Similarly, zoos have access to visitor research through associations such as the ZAA. According to AZ3, useful research has come from some of the Australian zoos in the ZAA, "*based around social action and social behaviours, things like signage and what works for people*" (AZ3). Staff at Orana Park also use their ZAA connections to implement methods that have been proven to work: "*You need to be able to show that what you're doing works...I'll feed back into those [Australian] networks and if it gets validated and shown to be successful, then I've got data I can use here to go to the board and get money in order to implement it*" (OWP3).

According to OWP3, most of the research conducted at the zoo relates to improving husbandry or improving survivorship in the wild. Examples of research conducted by zoo staff and external researchers at the zoos are shown in Table 4.9.

Table 4.9: Research conducted at the case study zoos.

Zoo	Research
Auckland Zoo	• Research on frogs and bats for DOC • Vet team aided DOC with seal rehabilitations and whale necropsies
Orana Park	• Researching stereotypy in kiwi • Kea Conservation Trust researched repellents associated with 1080 pesticide
Willowbank	• Passage of food through kea gut, to understand seed dispersal

4.4.5 Captive breeding and release

All three of the zoos are involved with captive breeding. According to WWR3, Willowbank has a number of species being bred, but the main species are North Island brown kiwi, which has been bred at Willowbank for twenty years, and tuatara. Orana Park also breeds kiwi, which are sent to other New Zealand institutions and used to sustain the captive kiwi population. Any kiwi surplus to the captive population can be released into the wild: "*we've got 4 kiwi lined up to be released into the wild in Rotokari next month*" (OWP1). Blue duck and brown teal are also bred at Orana Park and released into the wild. OWP1 noted that other species at the zoo, such as Antipodes Island parakeet (*Cyanoramphus unicolor*) and tuatara, are held as 'bachelor' or 'bachelorette' groups for the breeding programme.

Auckland Zoo is breeding, or attempting to breed "*everything, from invertebrates to reptiles to all the birds*" (AZ3). Examples of species that have been bred include tuatara, kiwi, New Zealand mantises, and giant weta (*Deinacrida* sp.), which have been released into the wild. For other species, captive breeding is still in experimental or research stages, such as for Archey's frog, as mentioned in section 4.4.4.

The importance of captive breeding in zoos was recognised by DOC practitioners: "*the captive breeding programme is a direct benefit where birds will breed, and in most cases they provide an insurance population*" (DOC1). However, DOC1 also noted that while releasing captive-bred animals into the wild is ideal, it has been of limited success so far.

4.4.6 Captive rearing

In addition to breeding indigenous species in captivity, zoos are rearing indigenous species in captivity before releasing them back to the wild. The best example of this is Operation Nest Egg (ONE), in which kiwi eggs are taken from nests in the wild, and then incubated and hatched in captive facilities (including zoos) around the country. The chicks are then reared in captivity until they reach a certain size, and are then released back into the wild: "*they don't*

breed the animals and then keep them, it's more a case of assisted raising and protecting them at the vulnerable stages" (DOC2). Both Auckland Zoo and Willowbank are involved with ONE.

Operation Nest Egg began as a research project, and has expanded to a nationwide conservation programme with a high rate of success: "*there are steps to follow, and it's really reliable. We get really high hatch rates, so if a kiwi egg's coming in here, it's got about a 94-96% chance of being hatched and being released to the wild*" (AZ3). AZ3 also stated that ONE is a good advocacy tool, and considered it to be "*one of the high profile aspects of kiwi conservation*" (AZ3).

Zoos engage in captive rearing for other indigenous species too. According to DOC2, tuatara have been captive reared in zoos. AZ3 also stated that Auckland Zoo is incubating New Zealand fairy tern (*Sterna nereis davisae*) eggs off display for the fairy tern recovery programme.

4.4.7 In-situ conservation

In-situ conservation is another of the criteria used in the evaluation, and the information gathered shows that there are a variety of ways in which zoos can be involved in in-situ conservation. One of these methods is providing funding for in-situ conservation projects. The New Zealand Conservation Trust (NZCT) at Willowbank are beginning to raise money to help DOC fund Operation Nest Egg, in which Willowbank takes part: "*because Waimak DOC is facing pretty significant cuts in the funding they're going to receive for monitoring and retrieving Greater Spotted Kiwi eggs from the wild...if we want that programme to continue, we're going to have to be fairly proactive in trying to raise money to support the field work for DOC*" (WWR4).

Auckland Zoo also contributes money to conservation through its small grants programme: "*it removes those elements of needing to have a connection to our collection or Auckland Zoo involvement; it's just about facilitating great stuff on very little money*" (AZ2). Auckland Zoo conducts fundraisers and accepts donations from the public. It also 'ticket clips', in that $1 from every ticket sold goes directly into the zoo's conservation fund. According to AZ2, the ticket clipping allowed $400,000 to be budgeted for in-situ conservation work during 2012. "*That doesn't include the zoo's investment in having zoo staff assist with those projects in way or another. And of course our biggest investment in that is with the native projects because that's the most cost effective way*" (AZ2). Auckland Zoo's financial contribution to in-situ conservation was noted by DOC3: "*more and more, they're supporting projects*

nationally and for instance, they've helped support some of our Maui's dolphin research. They're about to fund kiwi surveys in the Coromandel, and that will help us in the lead up to our translocation of kiwi from there to Motutapu [Island]" (DOC3).

The zoos also use native plantings and pest control to make the zoo grounds a suitable habitat for wild indigenous species to live: "*we're basically trying to make it a really nice native habitat to encourage wildlife to come in*" (OWP2). According to OWP2, Orana Park was built on a barren area of gravel land: "*everything's been grown and built as the park's evolved, so it's great to know we've created an actual environment for other wildlife to come and live in as well as the species we have here anyway*" (OWP2). Wild species in the Orana Park grounds include bellbirds (*Anthornis melanura*), scaup (*Aythya novaeseelandiae*), and pukeko. Auckland Zoo also plants native flora where possible, and runs pest control as part of its Urban Ark programme. According to WWR1, one of the long-term goals for Willowbank is making the reserve completely predator-free: "*we could run the whole reserve as almost like a native island in Christchurch city*" (WWR1).

Another method in which zoos can assist in-situ conservation is by having staff assist in the field. According to OWP2, nearby Peacock Springs is where all the brown teal and blue duck from around the country are taken before being released into the wild: "*we often go down and help them do transmitters and things before they go*" (OWP3). Auckland Zoo has made a strong commitment to staff involvement, with two staff members in the field at any given time: "*that's to use skills, but also to train and learn, so it's sharing in development across organisations*" (AZ1). According to AZ2, 3000 hours of staff time had been spent in the field from January to July 2012. AZ2 stated that staff engaged in in-situ conservation are not only the keepers and gave the example of educators putting together an education plan and interpretation: "*we try and look at all the skills we have at the zoo we can try and deploy for a conservation benefit*". DOC3 mentioned that the grounds staff from Auckland Zoo assist DOC with weed control and plant work on the islands in the Auckland area.

Other examples of ways in which Auckland Zoo staff have contributed to in-situ conservation include assisting with kakariki (*Cyanoramphus* sp.) research on Tiritiri Matangi Island; taking inventory of kokako (*Callaeas cinereus*) in the Waitakere Ranges; and assisting with the response to the Rena oil spill (AZ2). These efforts were recognised by DOC3, who stated the importance of zoos contributing to in-situ conservation work: "*it's not just breed-for-release and advocacy – it's that bit in the middle where they're actively doing conservation work as well*" (DOC3). In the course of contributing to in-situ conservation work, zoo staff are collaborating with other organisations in the field.

4.4.8 Collaborations

Interviews indicated that the zoos collaborate with other New Zealand zoos, either with the zoo as a whole or through connections with individuals at the zoo. One of the areas mentioned by the practitioners in which they collaborate is in the husbandry of the animals: "*we're having trouble getting our kaka to breed, so we've been talking to Hamilton and Auckland and the botanical gardens down in Dunedin about exactly what their diet is and what their nest boxes look like*" (WWR1). AZ2 also mentioned collaborations with other New Zealand zoos: "*we're certainly aware of what each other is doing, we co-operate when we can, and we share information, which is kind of key*" (AZ2). According to WWR1, the connections used when looking for advice about a specific situation are through connections related to the species: "*it's more of a private network rather than one of the major organisations... you email someone who emails someone who can tell you something*" (WWR1).

Relationships with other zoos through organisations such as ZAA are also used by zoo practitioners. "*The zoos have an Australasian Association [ZAA], so working together you tend to inspire each other, but also collaborate*" (AZ3). Examples have also been given earlier in the chapter of Auckland Zoo and Orana Park using research on zoo visitors from ZAA Australian member zoos. Willowbank used to be a member of ZAA but the owners decided to discontinue their membership: "*we're not now, which does make it a bit more difficult. It means that we're much more isolated, and if we want to do anything we can't swap manuals with other zoos*" (WWR2).

OWP3 praised the collaboration that takes place in the Zoo Education Network: "*bouncing ideas amongst everybody else there…as educators, I've never come across a group that exchanges stuff so freely as the zoo association people. Because no matter how good a programme I write here, I'm not going to steal [another zoo's] market. So you'll hand over entire packs, entire resources, ready to go – you'll even strip off the branding and say 'just put your name on it, it's cool', because it doesn't matter. It saves somebody else reinventing the wheel, and then six months down the track they're going to have something you want, and that really is the way this network works*" (OWP3).

In addition to collaborating with other zoos and zoo staff, the zoos were involved with a variety of other organisations. AZ1 and AZ2 mentioned a number of organisations involved with Auckland Zoo: Forest and Bird; Supporters of Tiritiri Matangi [island]; the Motutapu [island] Restoration Trust; Te Hanga Wetland Restoration Group; the Kea Conservation Trust; EnviroSchools; Ministry of Education; Ministry of Primary Industries; and the zoo is a

part of Regional Facilities Auckland, a council-controlled organisation of the Auckland Council.

According to AZ1, despite the large amount of time spent communicating, "*the number of partnerships and working relationships we have is fundamental to the operation of the zoo*". AZ2 stressed that conservation is not something that can be done by one institution on its own, and noted that there are benefits to be gained in combining resources. AZ1 stated that the collaborations the zoo engages in allow for better advocacy: "*we can do the field work, we can do the habitat work, we can do the in-zoo work, and we can link it through. The keeper who was on Rangitoto yesterday is giving an encounter today talking about what she did yesterday, what she's doing today, and what she's going to do tomorrow, and talking about the kaka or the kea that she's handling there and then*" (AZ1).

Zoo practitioners also emphasised the importance of their relationship with DOC: "*the Department of Conservation is one of our key partners*" (AZ2). An apparent outcome of the involvement of DOC in species management is that zoos co-operate with other institutions: "*they're still DOC birds, and it's the same with the Operation Nest Egg kiwis. They're all DOC birds, they're not Willowbank birds, so the relationship with DOC is pretty important*" (WWR1). The role of DOC and species management programmes in relation to zoos is further explored in the following section.

4.4.9 Measuring success

Each of the zoos were able to quantify success in captive breeding: "*the way we measure is what we produce…we just keep track of numbers*" (WWR1). OWP2 added that the keepers try to better previous seasons, although AZ3 cautioned that quality is important in addition to quantity, "*especially around the genetics of founding populations*" (AZ3).

However, the zoo practitioners also agreed that it is much more difficult to measure success for education and advocacy. Willowbank staff gauge the success of their education programmes by return visits, whether (or how often) a school or group asks them to come back for another talk.

Orana Park measures the success of the school programmes by handing out surveys to the class teacher for the students to fill in. According to OWP3, the most important section of this survey is when students complete sentences, for example: 'Coming here has made me aware of…'; 'Now I understand why…'; and 'From now on I am going to…'. OWP1 also stated that the zoo conducts visitor surveys which asks questions relating to what conservation messages the visitors have learned in the zoo. However, visitor surveys are labour intensive,

and staff usually rely on anecdotal evidence gathered by volunteers to measure the success of keeper presentations: "*our guides would tell us that they would see people in the audience nodding their heads or going 'Oh, really?', so that's an acknowledgement of the fact that it's getting through*" (OWP1).

Auckland Zoo also uses a combination of evaluative tools, and focuses in particular on change in conservation actions among students. One of the methods of measuring this is by using surveys, asking students to identify the most significant change they are aware of. Some schools provide one-off feedback for the zoo, while other schools maintain a relationship and the zoo can gain further information for change in conservation actions. "*Not all of the data is rich and deep, but however we gather the data there is a definite trend to engagement in conservation*" (AZ1).

Measuring the success of advocacy in zoos is also an issue for DOC practitioners. According to DOC1, part of the process of zoos forming an advocacy plan is building in performance measures. However, DOC is also uncertain of how to measure advocacy success: "*we also need to improve on performance measures in advocacy plans…somewhere along the line we've got to be able to measure that. We've got to be able to say 'Can you actually show that having this particular species in captivity is actually benefiting the species in the wild? Is there a wider understanding from the general public of the plight of the species?', and that sort of thing. So the issue is trying to get some measures in there to show that it is useful having these species in captivity*" (DOC1).

4.4.10 Management programmes

Practitioners at the zoos stated that the management for the native species was decided by the external 'captive co-ordinator' for the species rather than by the zoo staff: "*our native species are part of managed breeding programmes. It's all scientifically managed as to who can breed with who*" (OWP1).

The captive co-ordinator is appointed by DOC, but is not necessarily part of DOC. According to DOC1, "*in most cases, the captive co-ordinator is in a zoo. It's a person that is familiar with the species and the requirements of that species, and is associated more often than not with a recovery programme*". The role of the captive co-ordinator is to manage the genetics of the species, which includes managing where individuals are going next to allow for maximum genetic variability (DOC1). DOC is responsible for running the recovery programmes for each species, in which the captive co-ordinator is included: "*a number of endangered species have recovery groups and what they do is to manage the way that that species is managed in*

the wild – what things are required etc and quite often a component of that is captive breeding. As part of that recovery group they'll have the captive co-ordinator and that captive co-ordinator sits in on the meetings. During those meetings the captive requirement is set out for the following year and what that captive co-ordinator tries to do is manage what's required for that" (DOC1).

In addition to supervising the recovery programmes, DOC is responsible for the authorities and permits for individuals of a species to be held in captivity. According to DOC3, the primary requirements for holding indigenous species are having appropriate facilities and space, and being able to prove that the individuals are coming from an appropriate source. "*What we're tending towards now is that apart from injured birds, native species will only be brought into captivity for advocacy purposes or for a captive breeding programme*" (DOC1).

4.4.11 Conservation policy

Auckland Zoo is the only case study zoo to have a conservation policy in place for the whole of the zoo. According to AZ1, the policy was developed after the issue of mining on the Coromandel Peninsula arose about two years ago; staff responded on a personal level but had no guidance as to the stance of the zoo on conservation issues. The conservation strategy contains the "*underlying principles, the key issues, and then we've got the conservation message or platforms, and for each of those we've got areas that Auckland Zoo is active in and what we're doing about it*" (AZ1). Some of the areas with specific goals derived from the conservation strategy are the zoo's conservation fund, education, and marketing (AZ3). In terms of indigenous species, "*we've got a number of policies around what programmes we're involved with, and really it's about maximising our contribution with the resources we have, and directing our skills and our facilities to where they're best used*" (AZ3). According to AZ2, the strategy emphasises relationships and advocacy, and uses the WAZA Conservation Strategy 2005 as a guide: "*it's a really well written document, and it's a few years old now, but it's really just common sense. You know, do what you can regionally, in your own backyard. And that's why our division of resources is pretty much half and half exotic and domestic*" (AZ2).

In addition to the conservation strategy, Auckland Zoo has a strategic plan which is more conservation-focused than its predecessors: "*our new strategic plan is very much focused on wildlife in the wild, and so that is at the forefront of the staff. It gives us the mandate to say 'we're going out to the wild to do this', and so we need the staffing…*"(AZ1).

The other two zoos do not have a conservation policy for the whole of the zoo, but there are plans made for conservation in specific areas. An example of this is education at Orana Park: "*we've developed internal presentation guidelines which set out key conservation messages we want to get across as a Trust. We've identified specific take home actions that we want delivered to our visitors, and then we've identified a suggested structure so that our presentations convey key information…it's, 'why are they threatened?', 'what can people do?', 'what do we do at Orana?'*" (OWP1). These presentation guidelines and their associated conservation messages are used widely around the Park, in education messages to school groups where possible, interpretation, keeper presentations, and in press releases. However, there is no conservation policy relating to the animals. According to OWP2, the associations such as ZAA give recommendations for the exotic species, and the species co-ordinators give recommendations for the native species: "*we're following the recommendations made to us by those co-ordinators. So they give us the pair or tell us what pair we're going to have and tell us they want them to breed*" OWP2).

Similarly, Willowbank does not have an overall conservation policy but staff focus efforts on in-situ programmes relating to the indigenous species in the zoo. "*The holding of any native species has to be with the conservation of it in mind, so we try to involve ourselves with whatever programme is relative to that particular animal*" (WWR1). In addition to indigenous species, however, all of the case study zoos also hold exotic species. The next section examines practitioners' perspectives on the roles of indigenous and exotic species within the zoos.

4.4.12 Exotic species

All of the case study zoos exhibit both exotic and indigenous species. An interesting trend noted among the zoo practitioners is that they see the exotic species as necessary to attract the public. Conversely, they do not think that indigenous species could not attract visitors on their own. "*New Zealanders are probably less interested to come and see the native species but that's the section that plays a much more important role in conservation. The exotics are more of a drawcard, while the focus for natives is conservation*" (WWR2). Staff at Orana Park also stated that the exotic species were responsible for attracting visitors: "*local people will race through the doors to see our lions and giraffes and tigers and the like, but not necessarily our blue duck which we breed for release to the wild*" (OWP1). OWP2 supported this statement but added that the practitioners are able to advocate for indigenous species when visitors are inside the zoo: "*unfortunately often a little gecko or something might not be*

the drawcard to bring people in, but a giraffe or something will. And then once they're here we're going to try and educate them as much as we can about native species" (OWP2).

This view is supported by the conservation practitioners at DOC: "*I wouldn't expect zoos to just move into native conservation, because our animals are pretty cool, but if you want your 6 year old or your 3 year old to really have an awe of the environment, then you show them the cheetahs and the lions and the elephants. They won't get such a buzz out of the difference between a kaka and a kea and a kakariki*" (DOC3). DOC2 agreed that exotic species are the primary attraction in zoos: "*Auckland Zoo have a whole load of stuff. They've obviously got the exotic species, which is their main attraction*" (DOC2). This practitioner also suggested that zoos continue to use exotic species as a way to raise money for indigenous species.

4.4.13 Zoos' contribution to conservation

When asked how they saw their zoo's contribution to conservation compared with conservation as a whole in New Zealand, practitioners tended to view themselves as part of a 'big picture': "*we're part of the puzzle, but we do see captive centres including us as being critical in terms of native species conservation*" (OWP1). This was supported by OWP2, who views zoos as "*part of the mechanism*". WWR1 also stated that they perceive zoos as playing "*a small but significant role*" in New Zealand conservation.

Some of the practitioners also measured their response against a particular area that the zoo is engaged in. An example of this is the zoos' roles in management and breeding of indigenous species: "*with the kea and kaka programmes, we're involved in decision making with future breeding and studbooks*" (WWR1). Similarly, WWR4 measured their response against progress for the kiwi: "*I think we've had a really big influence and big input into the numbers going back into the wild…we had the only facility in the South Island involved in incubating the South Island species [Southern brown kiwi (*Apteryx australis*)], so we definitely had a big part in getting those numbers up*" (WWR4).

The area in which most practitioners emphasised their role in conservation was in conservation advocacy: "*we've got a great opportunity collectively just because of the number of people that come to our gates, and we speak to quite a large audience*" (OWP1). AZ2 also mentioned the volume of visitors that can engage with indigenous species by visiting the zoo: "*you can have 700,000 people come through here and connect with New Zealand species, and it's in a way that isn't going to damage the environment...not everyone can go to Arthur's Pass, or have the hiking and camping gear you need to go to some parts of New Zealand. But here you can wear a pair of jandals on a nice day and see most species that New Zealand*

has" (AZ2). The view that AZ2 expressed was echoed by several of the other practitioners. They stated that in order for people to understand and change their habits to allow conservation to be successful in-situ, the public needed the chance to see the animals up close. "*We can do all the breed for release but they've got to have somewhere to go. It's really important to get people to connect with their environment as well, and have them want to look after what's out there*" (OWP2). The DOC practitioners supported this view: "*I'll never get to see a kakapo in the wild, and my only chance of seeing one is if it comes to a zoo, and I think that's the case for the majority of people*" (DOC2). After commenting on the importance of advocacy, AZ2 also suggested that conservation advocacy was the role of zoos that would have the most impact long-term: "*ultimately, I think advocacy could have a greater, more long-lasting impact. It's advocacy that will make a difference*" (AZ2).

DOC3 also perceived zoos as having a role in conservation in New Zealand: "*I think that they are well placed... to be able to provide support to conservation programmes one way or another, whether it be by advice or advocacy, or things like breed to release or active involvement in community projects. I think zoos have a real role there*" (DOC3). In addition, this practitioner stated the importance of zoos advocating for conservation, and that the more people and organisations they can encourage to become involved, the better: "*we just don't have the capacity to do all the conservation, and if we were doing all the conservation…it would just be something that DOC does. People wouldn't have to worry about it themselves because 'DOC will do that', 'DOC will save the dolphins and we don't have to bother', and so that wouldn't necessarily lead to people behaving in a way which would conserve the environment*" (DOC3).

4.4.14 Role of zoos in the future

Practitioners at Auckland Zoo showed a high expectation of continuing their in-situ work in the future: "*I think increasingly there are continuums of management* ex-situ *and* in-situ*, and our off display is as important or will become more important than our on display*" (AZ1). AZ2 also stated that while ex-situ conservation would continue, in-situ conservation was expected to increase: "*we'll continue to be involved with the breed and release programmes; we'll continue to develop and deploy zoo's resources outside the zoo*" (AZ2). OWP2 agreed that in-situ conservation would play a more prominent role in the future: "*I think more direct involvement in conservation is probably something that a lot of zoos are heading towards*" (OWP2).

The role in which the practitioners expected the zoo to be most active was advocacy: "*I hope as more and more wildlife's coming back to Auckland, we can keep educating people, like you*

saw yesterday with the kaka. And making sure that that human conflict with wildlife issue is minimised. And I guess really continuing to inspire and empower people to get out and contribute as much as they can, and make smart choices in their day to day lives" (AZ3). OWP1 reiterated the importance of advocacy as a zoo's key role: "*I see zoos as still having a key and influential role moving forward, particularly in advocacy work... I guess overall, our job is to empower the next generation – the future caretakers of our biodiversity and animals – to ensure that they want to protect them like we're trying to*" (OWP1).

In DOC2's opinion, zoos should definitely have a role in conservation in the future, particularly because of their education and advocacy role: "*You can wow [children] with whatever you want to wow them with, so I think zoos are the perfect opportunity because the kids aren't going to be seeing these things in the wild*" (DOC2). DOC3 supported the zoo practitioners' opinions of growth in both the advocacy and in-situ roles: "*I think that they'll have a continuing and growing role in advocacy for native conservation... and hopefully continuing to grow their direct contribution through advice or technical skills*" (DOC3).

4.4.15 Summary

Many of the themes discussed by the interviewees reflected the criteria used for the evaluation, such as education, in-situ conservation, and collaboration. However, the interviews also highlighted trends in practitioners' perspectives that were not found during the desk-based stage of the research. The most notable of these is the importance placed on conservation advocacy by zoo and conservation practitioners alike. The following chapter draws upon the information gathered in the evaluation and literature to discuss the trends found in the research.

Chapter 5
Discussion

Throughout this discussion chapter, points raised in the literature are further examined and compared to the information found over the course of this research. The first section of this chapter discusses the definition of a zoo used and how New Zealand zoos applied to the definition. The following section discusses the multiple roles which zoos perform. The roles of conservation and education are then further examined, divided into ex-situ conservation, in-situ conservation, advocacy, and research. Collaboration, a criteria used for the evaluation, is discussed next. The chapter concludes by examining two final themes raised by the practitioners and the literature: the presence of exotic species in New Zealand zoos, and the financial implications of zoos' contribution to conservation.

5.1 Revisiting the definition of a zoo

Selecting a definition of a zoo was an essential component of the early stages of the research. The definition used was: 'An institution which houses a collection of primarily terrestrial wildlife and is open for members of the public to view the animals'. This definition is most similar to that used in the 1993 World Zoo Conservation Strategy, which according to Linke and Winter (2011) defined a zoo as an institution which houses a collection of wild (non-domesticated) animals, and displays at least part of the collection to the public.

While identifying zoos in New Zealand, a variety of institutions were found that met the definition that perhaps would not ordinarily be considered a 'zoo'. Examples of these institutions include:

- aviaries in botanical gardens and privately-owned gardens which are open to the public;
- public attractions which primarily focus on other areas but also have indigenous species (for example, Southland Museum has tuatara (*Sphenodon* sp.) and the International Antarctic Centre has little blue penguins (*Eudyptula minor*)); and
- eco-sanctuaries or mainland islands.

The last of these was especially interesting as it raised the issue of what constitutes captivity in order to be considered a zoo for the purposes of the study. The mainland islands are reserves of land which are isolated from predators, due to predator-proof fences, geographic features, or intensive pest control. Therefore it is reasonable to assume that any species inside the fence which cannot fly is 'captive'. However, the size of the sanctuary within the fence is also a factor. For example, the fence at Zealandia is 8.6 kilometres long and encloses 225

hectares. Depending on the natural range of a species and how many individuals of the species are being kept within the fence, it is debatable as to whether or not the species could still be considered to be captive. Each of the institutions was carefully considered before it was decided whether or not they met the research definition of a zoo. For example, Zealandia was included because the website specified that within the sanctuary there are also protective enclosures, such as tuatara nurseries and gecko rearing enclosures. The wildlife reserve at Pukaha Mt Bruce is unfenced but pest controlled to provide a safe habitat for indigenous species. However, in addition to the reserve, Pukaha Mt Bruce has captive facilities including a kiwi house, and therefore it meets the definition used of a zoo. Conversely, Orokonui Ecosanctuary was not counted as a zoo because, despite its 307 hectares being enclosed by a predator-proof fence, the bird species shown on the sanctuary website are all flighted. The website mentions a lizard habitat, but there are no indications as to whether the habitat is enclosed or open. Riccarton Bush is another area of forest surrounded by a predator proof fence. Despite being smaller at 12 hectares and containing kiwi (*Apteryx* sp.), it was also not counted as a zoo because the visitors do not go to see the kiwi (Riccarton Bush is open only during the day, and kiwi are nocturnal). Instead, the species that visitors to Riccarton Bush could expect to see are flighted and therefore not in captivity.

A variety of words were used in the zoos' names to describe the facility. Examples include 'Zoo', 'Zoo and Wildlife Park', 'Gardens', 'Reserve', 'House', 'Animal Park', and 'Wildlife Centre'. Six of the zoos had no descriptive or defining word as part of the name at all, such as Kiwi North and Owlcatraz. The wide range of words used indicates that basing a definition of a zoo on how the zoos describe themselves would not be possible. It also raises the question as to the differences between the words in their interpretation and the extent to which wildlife centres, parks, and reserves differ from one another.

Furthermore, the differences between a zoo and a sanctuary are also relevant. As noted with the examples above, Zealandia and Pukaha Mt Bruce are considered to be sanctuaries. They each provide safe habitat for flighted bird species and in the case of Pukaha Mt Bruce, the non-flighted species within the reserve are also free. However, the two institutions have additional captive facilities for species. At all three of the case study zoos, indigenous species were observed roaming freely within the zoo grounds. Both Auckland Zoo (AZ) and Orana Wildlife Park (OWP) staff stated that pest control was taking place within the zoo grounds. Therefore, like the sanctuaries, these zoos are also providing safe habitat for indigenous species. Currently, zoos can still be considered distinctly from sanctuaries, in that sanctuaries have only indigenous species, and visitors go to see the free individuals, usually in a setting of

indigenous flora. In contrast, the zoos often also contain exotic species, and it is the species in captivity that the visitors go to see rather than those roaming in the grounds. However, if zoos continue to evolve and encourage free-roaming species into their grounds, and sanctuaries acquire more species which require captive facilities, the two may become more difficult to distinguish.

5.2 Multiple roles of New Zealand zoos

It is clear from the literature that zoos perform three major inter-linking roles in conservation, education, and entertainment. The research reported in this study showed that the majority of New Zealand zoos are engaging in activities related to one or both of conservation and education. OWP1 also supported this by stating that: "*A modern zoo is here for a number of reasons, which are: recreation, visitor's education, conservation of endangered animals, and research*". In addition, statements from zoo practitioners and conservation practitioners from the Department of Conservation (DOC) indicated that visitors are still going to zoos primarily for entertainment, which is consistent with the literature (Shackley, 1996; Ryan & Saward, 2004; Körner, 2010; Linke & Winter, 2011).

While the literature mentions conservation, education, and entertainment as being the main roles of a zoo, many authors did not place more importance on any one of the roles. Dickie, Bonner, and West (2007) were one of the exceptions, who suggested that using peoples' emotional response to individual animals in zoos to address wider conservation issues was a key role of modern zoos. The practitioners interviewed in this research, both from zoos and from DOC, agreed that while zoos' other roles should not be ignored, conservation advocacy was the most important role of a zoo. According to DOC1, any animals brought into captivity (with the exception of injured animals) must be for captive breeding or advocacy purposes. This again reflects the level of importance placed on advocacy.

Practitioners agreed that while advocacy was the most important role of the zoo, the other roles should not be ignored. A point that was emphasised, particularly by OWP1, was that the public visits the zoo to be entertained, and that along with their other roles, zoos need to ensure that they still provide entertainment in order to attract visitors. The interviewees gave a good example of this when they spoke of the keepers sharing their experiences with the public. For example, at Orana Park the keepers talked about their job and involvement with the animals ex-situ in the zoo. Auckland Zoo emphasised staff involvement in the field, and staff talked to the public about their in-situ conservation work. This demonstrates the interconnectivity of zoo roles, in that by speaking of their conservation involvement, the

keepers were able to advocate nature conservation in a manner which visitors found to be both informative and entertaining (OWP1).

Frost (2011) suggested that given the variety of zoos' roles, stakeholders in zoos including management, staff, and visitors could be confused as to the overall identity of the zoos. The zoo practitioners interviewed were from a variety of positions in the zoos, primarily keeping staff, educators, and public relations or marketing. Some also played a leading or managerial role within the zoos. Despite this variety of roles, the interviewees were unanimous in describing considerations for conservation within their job, and emphasising the importance of advocating for conservation to the public. A number of the practitioners also spoke of the multiple roles of the zoos, particularly in the context of attracting visitors to the zoos (entertainment) while focusing on conservation and education. This suggests that the management and staff within the zoos view the identity or purpose of the zoos in a similar way. However, the literature showed that visitors' main motivation in going to the zoos was for entertainment (Shackley, 1996; Ryan & Saward, 2004; Körner, 2010; Linke & Winter, 2011). The practitioners supported this, and added that the exotic species were the drawcard for visitors rather than indigenous species. This supports Frost's (2011) observation that while the management and staff of the zoos might regard the entertainment role as necessary to draw visitors to then engage in education and conservation, the visitors see the entertainment role as the main purpose of the zoos. The literature suggested that visitors could be learning at the zoos through education that they find entertaining or 'edutainment' (see Körner, 2010). Given that the zoo practitioners recognise the focus of visitors on entertainment, it is likely that they are already making an effort to ensure that visitor education and advocacy is conducted in a manner which visitors find entertaining. An example of this is the interpretation in the case study zoos: practitioners at each of the zoos recognised that new interpretation needed to be interesting in order for visitors to stop and read the information.

This section has focused on the multiple roles of New Zealand zoos, particularly those of conservation, education, and entertainment. The purpose of the thesis is to examine the contribution to conservation of New Zealand zoos; therefore, the following sections will discuss zoos' contributions in ex-situ conservation, in-situ conservation, advocacy, and research in greater detail.

5.3 Zoos' contributions to ex-situ conservation

Although conservation advocacy was identified as the most important role of a zoo, several of the zoo practitioners specified that captive breeding was also important and should therefore

continue. According to the conservation practitioners from DOC, captive breeding from zoos alone is not enough to make a difference in the wild. Zoo staff stated that while they would like to release more individuals into the wild, the primary purpose of breeding in captivity is to sustain the captive population and to have an 'insurance' population. DOC staff placed less importance on captive breeding, saying that they had not heard of many cases where individuals were released back into the wild, although this does not mean it has not occurred. Despite this view, DOC3 stated that zoos seemed to be enthusiastic about increasing their breed-for-release programmes, but that there isn't a nationwide policy to facilitate them. DOC3 pointed out that extensive work is required to ensure the individuals are being released in an appropriate place, but stated that DOC "*could be a bit clearer about some of our aspirations in terms of breed for release*" (DOC3).

According to DOC1, DOC aims to bring indigenous species into captivity only for breeding or advocacy purposes. A captive population kept for advocacy still needs to be sustained over time, which means that captive breeding still needs to take place regardless of whether or not the offspring will be released into the wild. For example, this is the role played by the kiwi at Orana Park. The primary purpose of breeding the kiwi is to sustain the captive population as a whole, so kiwi have been sent to other captive institutions around the country (OWP2). However, according to OWP2, several of the kiwi that were not required for captivity have been released into the wild.

In addition to breeding species in captivity, the research suggested that it is common for New Zealand zoos to rear wild-born individuals in captivity before releasing them back to the wild. Despite much debate in the international literature on breeding animals and raising the offspring in captivity (Tribe & Booth, 2003; Catibog-Sinha, 2008; Conde et al., 2011; Frost; 2011), no literature was found which focused on bringing young into captivity to be reared and then released. This suggests that captive rearing might be a conservation strategy unique to New Zealand. Introduced predatory mammals are the biggest threat to indigenous species in New Zealand (Craig *et al*., 2000), which differs from other countries where mammalian predators are native. The most common example of captive rearing in New Zealand zoos is Operation Nest Egg. The reasoning behind the initiative is that kiwi chicks are vulnerable to predation, but adults are not (Operation Nest Egg, 2012). Therefore, rearing young individuals in captivity allows them to reach a size where they are better able to defend themselves and therefore are not as vulnerable to predation. According to Operation Nest Egg (2012), only 5% of wild-hatched kiwi chicks survive to adulthood. The Operation Nest Egg birds hatched and reared in captivity have a 65% chance of surviving to adulthood (Operation Nest Egg,

2012). Given that the majority of the captive facilities involved with Operation Nest Egg are zoos (Operation Nest Egg, 2012), these figures provide a measure of the extent to which zoos are contributing to conservation in the context of captive rearing kiwi.

Captive rearing might be a method that zoos could extend to more species, either in addition to, or as an alternative to breeding the species in captivity. Captive rearing rather than captive breeding may also address some of the issues raised in the literature about captive breeding, such as some species being difficult to breed in captivity. However, many of the issues of captive breeding and reintroductions mentioned in the literature would still apply to captive rearing. Examples of these include cost; the possibility of individuals not learning survival skills; and limited space in captivity (Tribe & Booth, 2003; Catibog-Sinha, 2008; Conde et al., 2011).

Practitioners also noted that ex-situ conservation cannot be carried out in isolation, or that no matter how successful their captive breeding or rearing is, the animals depend on having suitable habitat in the wild to which to be released. They highlighted the importance of in-situ conservation and advocacy to change visitors' lifestyles, which will be discussed in the following sections.

5.4 Zoos' contributions to in-situ conservation

One method which Auckland Zoo used to raised money for its conservation fund was 'ticket clipping' - allocating $1 to the fund from every entry ticket sold. Despite this, the cost of entry is not higher than other zoos. The cost of an adult entry ticket to all three of the case study zoos is $25. It is possible that other New Zealand zoos may operate in a similar way or their management allocates budgeting in a similar way. However, for the zoos which are making little or no contribution to conservation, ticket clipping could be an effective method of allocating funds to be spent on conservation. The funds could be spent on conservation within the zoo, or be given directly to in-situ initiatives.

Another method in which zoos can engage in in-situ conservation is through staff involvement outside the zoo. Some authors have suggested that zoos collaborate with in-situ conservation work (Tribe & Booth, 2003; Stanley-Price, 2005). Zoo staff who are working in the field on conservation projects are typically collaborating with people outside the zoo (AZ2). For example, two members of Auckland Zoo staff are in the field at any given time. The staff members work on a variety of conservation projects predominantly in the Auckland area, which allows for connections to be made with DOC and with staff or members from other organisations. Additionally, the hours put in by zoo staff can help to alleviate strain on

the budget of the conservation project. Where organisations such as DOC are facing budget cuts, outside help is arguably valuable. In return, zoo staff are able to share and learn new skills associated with their jobs. Although other zoos will not have the capacity to be able to spare two staff members each day, involvement with in-situ conservation is an important contribution to conservation of indigenous species. Contributing to in-situ conservation can also be considered relatively straightforward compared to other forms of conservation such as captive breeding or education.

The staff at Auckland Zoo placed a particularly high emphasis on being able to relate their experiences with in-situ conservation to the public, as well as linking it to ex-situ conservation in the zoo. This was supported by DOC2 and DOC3, who stated that involvement with in-situ conservation at Auckland Zoo is particularly high compared to other New Zealand zoos. Auckland Zoo does have the largest budget and staff numbers of the zoos in New Zealand (AZ2), but, if staff at other zoos could contribute any efforts possible to in-situ conservation, they would also have the benefits of being able to advocate based on their experiences. Staff relating their in-situ experiences may help in linking the zoo to the outside world in visitors' perspectives and add credibility to the advocacy messages delivered within the zoo.

5.4.1 Zoo grounds as a habitat for wildlife

Another form of conservation observed in the case study zoos is facilitating wild indigenous species to live within the zoo grounds. While plants in exhibits are increasingly reflecting the habitat of the animals, as suggested by Bridgewater and Walton (1993), the planting outside the exhibits includes indigenous plant species. This was especially noticeable in the recently developed Te Wao Nui in Auckland Zoo. Indigenous bird species were observed freely roaming the zoo grounds at all three of the case study zoos.

Examples of the species seen include fantails (*Rhipidura fuliginosa*) at Willowbank Wildlife Reserve (WWR), pukeko (*Porphyrio porphyrio*) at Auckland Zoo, and scaup (*Aythya novaeseelandiae*) at Orana Park. It is not known how many of the birds were incidentally present along with the introduced bird species also seen, such as sparrows (family Passeridae) and blackbirds (*Turdus merula*). Figure 5.1 shows a wild pukeko in the grounds of Auckland Zoo.

Figure 5.1: A wild pukeko in the grounds of Auckland Zoo. Photo: Lauren Maciaszek.

Without figures documenting the numbers of wild indigenous species over time as native plantings increase, it is not possible to know if (or to what extent) native plantings are encouraging indigenous wildlife into the zoo. However, a guide to attracting native wildlife into gardens by DOC (2007) emphasises planting native species, in particular species with flowers and fruit. According to the guide, the species with flowers or fruit can attract tui (*Prosthemadera novaeseelandiae*), bellbirds (*Anthornis melanura*), and kereru (*Hemiphaga novaeseelandiae*) over considerable distance in winter and spring. These birds are also less commonly seen than those which would incidentally be seen around the zoo, such as fantails or silvereyes (*Zosterops lateralis*). This suggests that increasing native plantings within the zoo grounds would increase the diversity of wild indigenous species seen around the zoo grounds. Although there are no exact figures to show the numbers of wild animals in the grounds, an indication of trends could be gained from the casual observations of staff over time. For example, OWP2 stated that bellbirds have established at the park within the last number of years, and that a tui had also stayed within the Orana Park grounds for about a month. Staff thought that the tui came for the flowers and berries on the native plants, which supports the notion that planting native species attracts indigenous bird species.

In addition, pest control within the zoo grounds was mentioned by staff at Orana Park and Auckland Zoo. According to OWP2, the pest control is to ensure the safety of the captive animals as well as the wild animals within the zoo grounds. OWP2 gave the example of an indigenous skink species (family Scincidae) thought to be locally extinct, which was then rediscovered living in a small area of the zoo. The skinks are protected from predation with the park's pest control, and native plantings around their habitat have also increased since they were discovered. Auckland Zoo also runs pest control in the zoo grounds. It is part of the Urban Ark programme run by the zoo, which also extends beyond the zoo boundaries into neighbouring properties and nearby schools.

Witnessing wild indigenous species within the zoo may also improve visitors' (international and domestic) experiences at the zoo. The literature suggested that the public have mixed feelings about keeping animals in captivity. If the zoo is also a home for freely roaming indigenous species this may give visitors more positive feelings about the zoo. The species seen free in the zoo (such as fantails and pukeko) are also more common species that are not typically kept in zoos. This is a good opportunity for international visitors to see the species, and, depending on where domestic visitors live, they may also have the opportunity to view wild indigenous species which they do not frequently see.

Encouraging wild indigenous species into the zoo grounds by planting appropriate indigenous plant species is another simple method that zoos can use to contribute in a small way to in-situ conservation. It is especially suitable for small zoos looking to increase their contribution to conservation in that it is inexpensive compared to other forms of in-situ conservation involvement, and can be as simple as choosing native species over exotic species when planting or replacing flora. After planting indigenous species, zoos can advocate for their visitors to do the same to benefit indigenous fauna. The following section further discusses zoos' contributions to conservation through advocacy.

5.5 Advocacy: a critical role of zoos

Zoo and conservation practitioners perceived advocacy to be the most important role of a zoo. Advocacy was emphasised in the various forms of education that take place in a zoo, including the interpretation, formal education programmes for school groups, and keepers talking to the public. Furthermore, the interviews with practitioners suggested that, while the public is also taught information about species such as their preferred food or habitat, the overall aim of visitor education is to advocate for the conservation of the species and their environment as a whole.

5.5.1 Measuring zoos' advocacy

Despite the importance placed on advocacy by practitioners, it was also agreed that advocacy (and education in general) is difficult to measure. A variety of methods to assess the effectiveness of education were used by the zoos, including, most commonly, follow-up questionnaires for schools. Staff at Orana Park also use anecdotal evidence to gauge whether or not their advocacy messages are effective: "*our guides would tell us that they would see people in the audience nodding their heads or going 'Oh really', so that's an acknowledgement of the fact that it's getting through*" (OWP1). In terms of this research, the difficulty of measuring advocacy and education can also pose difficulties in evaluating zoos'

contribution to conservation as a whole. The other criteria selected are easier to evaluate in that factors such as captive breeding, research, memberships, and collaborations can be counted and measured. Education, and to a degree, in-situ conservation, are harder to measure. As suggested by Wilkinson et al. (2011), conservation actions rather than conservation output were used, which allowed all criteria for the research to be evaluated.

5.5.2 Zoos as an alternative to viewing animals in the wild

Some authors have suggested that zoos are a suitable substitute to viewing animals in the wild (Mason, 2000; Catibog-Sinha, 2008). The primary reason given for this was the damage that tourists can cause to natural habitats. Many of the zoo and conservation practitioners also spoke of zoos being an alternative to viewing indigenous species in the wild. The main reason given for this by the practitioners was that New Zealand's indigenous species – especially the least common – are found in remote places. For example, kea (*Nestor notabilis*) are only found in the Southern Alps in the South Island, while approximately 75% of New Zealanders live in the North Island. In addition, many of New Zealand's indigenous species are nocturnal, which makes it even more difficult for New Zealanders to see them in the wild. Both the conservation and the zoo practitioners stated that the public needs to be able to see the animals in order for advocacy messages to be effective. The practitioners stated that the most accessible place for most New Zealanders to see indigenous species is within a zoo and that for many indigenous species, the zoo environment is probably the only point of contact for the public.

It is arguable that viewing New Zealand indigenous species in the wild is different from viewing exotic species in the wild. For example, viewing exotic species such as elephants and zebras in the zoo may be an alternative to going on an African safari. The rarer indigenous species in the wild in New Zealand are generally in such remote locations that the public will not go to their habitat for the primary purpose of seeing the animals. Instead, the most likely members of the public to see the species in the wild are people engaging in outdoor activities such as tramping [hiking] in the species' habitats. As such, viewing the species in the zoo is an opportunity for New Zealanders to see species they otherwise would not see, rather than being an alternative to viewing the species in the wild.

If viewing animals in the zoo is an alternative to viewing animals in their natural habitats or in a wild setting, it is arguable that as Mason (2000) and Catibog-Sinha (2008) suggested, the zoo would be preferable to avoid damage to the natural habitats and disturbance to the animals. Additionally, where zoos are effective at advocating, visitors to the zoos will pick up educational messages. If the advocacy messages can influence the visitors to change part of

their lifestyles or contribute in some way to conservation, the zoo is more beneficial to the species than if the public was viewing the species in the wild.

The topic of zoos as an alternative to other methods of learning about animals was also discussed in the interviews. The zoo practitioners viewed zoos as an important way to connect to the animals and suggested that other mediums such as television or the internet would not be as effective: "*if people can't see the animals or have a chance to meet them up close, how do you get them interested in the first place?*"(OWP1). DOC practitioners also agreed that getting the public to empathise with the animals is important: "*people only really start caring for something if they can understand it – if they can see it, touch it, that kind of thing. That's the best way to gain empathy for people, and until they have that empathy they're not going to have any input*" (DOC2). Similar perspectives have been suggested in the literature, for example, Stanley-Price (2005: 109) stated that "*each visitor is an opportunity for the demonstration of the wonders of nature... and messages about conservation. No office-based organization can showcase conservation so well*".

Given that zoos are seen as preferable to learning through other mediums and are more accessible to the public than viewing animals in the wild, it is clear that zoos offer a unique opportunity for the public to effectively engage with indigenous species. Due to the emphasis placed on advocacy by practitioners, zoos which are currently making little or no contribution to conservation or to education in particular would be best to focus on advocacy to increase their contribution to conservation. Information from the zoo staff who were interviewed suggested that making zoo staff available to talk with the public was an especially efficient way of advocating for conservation. This can be done immediately and at small cost, while other forms of advocacy such as creating interpretation will take longer to be ready for visitors.

5.5.3 Conservation advocacy and the New Zealand Curriculum

Both the zoo practitioners and the conservation practitioners suggested that zoos' ability to advocate to school groups is constrained by the school curriculum and what the teacher wants the zoo presentation to include. According to OWP3, the curriculum contains no requirement for environmental education or conservation or sustainability messages. However, the New Zealand Curriculum (Ministry of Education, 2007) states under the requirements for science that The Living World is a context that students from years 1-10 should have included in their science programmes. The descriptor states:

> *"The Living World strand is about living things and how they interact with each other and the environment. Students develop*

> *an understanding of the diversity of life and life processes, of where and how life has evolved, of evolution as the link between life processes and ecology, and of the impact of humans on all forms of life. As a result, they are able to make more informed decisions about significant biological issues. The emphasis is on the biology of New Zealand, including the sustainability of New Zealand's unique fauna and flora and distinctive ecosystems (Ministry of Education, 2007: 28).*

The New Zealand Curriculum is then used as a base for schools to develop their own curricula. The quote from the New Zealand curriculum suggests that the schools should be including a focus on indigenous species, their habitats, and their sustainability (conservation) in the science curriculum from years 1 to 10. However, the statements from practitioners suggest that the school teachers tend to ask for lessons on specific species or only one aspect of the curriculum. A possible explanation is that when organising school visits to the zoo, the teachers choose to only focus on species within the zoo or do not realise that the zoos are both capable of and willing to teach about whole ecosystems and conservation. As stated in the Chapter Four, it was common for zoos to offer ready-made programmes and worksheets for schools, and six of the zoos stated that their lessons could be customised upon liaison with the class teacher. Perhaps the inconsistency could be solved by zoo educators being familiar with the national curriculum requirements and promoting their abilities to teach about ecosystems and sustainability to class teachers when approached with specific topics.

5.5.4 Advocacy for sustainable resource use

In addition to advocating for conservation, Rabb and Saunders (2005) and West and Dickie (2007) suggested a variety of environmentally friendly ways zoos could operate, including conserving energy and water, and carbon neutrality. By doing so, zoos demonstrate their environmental awareness instead of just advocating to visitors about it. The information collected from zoos' websites showed that a number of zoos mention initiatives aimed at environmentally friendly resource use. It was included in the evaluation as part of the considerations for the in-situ conservation criteria. However, given the importance placed on advocacy by practitioners, zoos' environmentally friendly practices may be of more importance from an advocacy perspective. As discussed in the previous chapter, the case study zoos are linking the exhibits in the zoos to conservation actions the visitors can take. An example of this is the message on the kakariki (*Cyanoramphus* sp.) exhibit at Orana Park advising visitors to put bells on their cats to protect birds. If zoos could educate the public about the zoos' use of environmentally friendly practices and suggest ways for visitors to do the same, they could assist in encouraging visitors to change further aspects of their lifestyles to become more environmentally friendly.

In addition to contributing to conservation education by advocating, zoos are able to conduct research to contribute to the body of knowledge. The following section discusses research conducted by zoos in relation to conservation.

5.6 Contribution of zoo research to conservation

The results from this research differed to the literature in that authors in the literature placed importance on research, whereas New Zealand zoos did not place as much importance on it. Research is conducted in the zoos but it is often conducted by external researchers. Alternatively, zoo staff might conduct research at the request of an organisation or agency such as DOC. Where zoo staff conduct their own research, it is shared amongst other zoo professionals involved with the species rather than being published. Interestingly enough, the opportunity to conduct research in zoos may be of greater value to external researchers. DOC3 indicated that having captive populations such as those in zoos made it easier to conduct research. This is particularly so in areas where conditions or factors such as animals' diets need to be monitored or manipulated.

One argument in the literature in support of zoos' involvement with in-situ conservation was that zoos fund in-situ research and use that to complement research conducted in the zoo (Bostock, 1993). Based on the information gathered for the evaluation and the case studies, this appears not to happen in New Zealand zoos. In-situ research might be funded by zoos but not for the purpose of complementing ex-situ research. Instead, the research takes place in the zoos as an alternative to conducting research in-situ, and is generally prompted by external researchers or organisations rather than by the zoos themselves. A benefit of this approach is that the zoos are co-operating with researchers outside the zoo community for the research.

5.7 Zoos' collaboration for conservation purposes

Authors recommended that zoos collaborate with other zoos and also with various organisations and institutions (Tribe & Booth, 2003; Stanley-Price, 2005; WAZA, 2005; Catibog-Sinha, 2008; Conway, 2010; Conde *et al*., 2011). The research reported here has shown that New Zealand zoos do collaborate with one another, both through zoo associations and through personal connections with staff at other zoos. The zoos also collaborate with a variety of organisations, community groups, and institutions. The fact that the authors in the literature recommended collaboration rather than citing examples of its success suggests that as a whole, New Zealand zoos may be collaborating more effectively than zoos in other parts of the world.

A possible reason for this effort is the collaborative approach used for indigenous species management in New Zealand. The way that species are managed as a whole in New Zealand could also have other benefits. For example, Stanley-Price (2005) suggested that one of the benefits of zoo associations was that because the zoo representatives in the association knew each other, there was peer pressure to commit to global and regional conservation initiatives. With the way that indigenous species management is organised in New Zealand, zoos are reporting information back to the species co-ordinator - a person involved with the species, who could be a member of staff at one of the zoos. The information is released among the practitioners involved, which does allow zoos to compare with other zoos and facilities, or compare on numbers from previous years. WWR4 suggested that the information being shared might create peer pressure for zoos to ensure that they are doing their best with captive breeding to ensure they do not appear less favourable than other zoos. It appears that practitioners involved with a species know each other, through organised meetings such as the annual meetings for kiwi practitioners mentioned by WWR3. Meetings or organisations such as this allows practitioners to make connections with other practitioners and facilitates collaboration. In addition, as Stanley-Price (2005) suggested in the context of associations, connections with practitioners from other institutions could lead to healthy competition in that practitioners want to be seen positively by their peers in the industry and will want their zoo to commit to conservation.

5.8 Exotic species in zoos

The interviews revealed that both the zoo and the conservation practitioners considered exotic species in zoos as the drawcards for visitors. Interviewees stated that New Zealanders visit the zoo primarily to see the exotic animals, such as giraffes or tigers, rather than to see indigenous species. The viewpoints of the practitioners were supported by Moss and Esson (2010), who found in a study of UK zoos that mammals were the most popular taxonomic group with visitors. One of the reasons suggested by practitioners was that young children will be more interested and more in awe of the exotic animals, while "*they won't get such a buzz out of the difference between a kaka* [Nestor meridionalis] *and a kea and a kakariki*" (DOC2). Rather than attracting visitors to the zoo with indigenous species, the staff must wait until the visitors are at the zoo before they can attempt to advocate for indigenous species. The exception to this was Auckland Zoo, which AZ1 considered to have an especially high percentage of international tourists among its visitors due to the majority of tourists to New Zealand spending at least part of their stay in Auckland. According to AZ1, the main reason for the international tourists visiting the zoo was to see New Zealand indigenous species.

Some of the New Zealand zoos included institutions or sanctuaries which only contained indigenous species. An ideal example is in Wellington: Zealandia and Wellington Zoo are approximately 7.5km apart by road. Wellington Zoo could be considered a traditional form of zoo, with a mixture of exotic and indigenous species contained in exhibits. In contrast, Zealandia is an 225ha sanctuary for mostly free-roaming indigenous species, enclosed by a predator proof fence with multiple walking tracks for visitors. The two attractions would arguably draw different visitors, with those visiting Zealandia already having an interest in indigenous species. Given the information obtained from interviews, those visiting Wellington Zoo are more likely to be interested in the exotic species. Once they are in the zoo they may respond to advocacy messages for indigenous species.

If indigenous species are relying on exotic species to draw visitors, this raises questions as to how the conservation benefits should be divided between exotic and indigenous species. While it is important that New Zealand zoos contribute to the conservation of indigenous species, the exotic species should not be ignored. The literature suggested that there needs to be an appropriate reason for keeping animals in captivity, such as captive breeding or conservation advocacy (DEFRA, 2010; Frost, 2011). It is arguable that the zoos should continue involvement in conservation for exotic species to justify their presence as more than a drawcard for visitors. In addition, where exotic species originate from developing, or less wealthy, countries, it is reasonable to suggest that conservation initiatives in the species' area of origin are likely to be considered of low priority. If zoos in developed countries were to only focus conservation initiatives on their own indigenous species, conservation efforts for species such as the African mega-fauna would diminish considerably.

Orana Park demonstrated a method of linking advocacy for exotic species back to advocacy for indigenous species. Aside from giving money, there are often no changes that New Zealand citizens can make to their lifestyles that would benefit an exotic species. A well-publicised exception is the palm oil-free campaign run in multiple New Zealand and Australian zoos. The campaign advocates for the public to avoid buying products made with palm oil, which is obtained by cutting down rainforests in Malaysia and Indonesia and endangers animals' habitats (Orana Wildlife Trust, 2012). Where there is no clear way that New Zealanders could assist conservation for a species, Orana Park linked a conservation action back to conserving indigenous species. For example, on the interpretation on the otter exhibit, the conservation action was to reduce water pollution and wash cars on the grass. Such an action will not affect otters in their natural habitat, but can improve water quality in New Zealand streams and rivers, and benefit New Zealand species.

5.9 Financial implications of zoos contributing to conservation

One of the arguments in support of zoos' role in conservation was that by zoos engaging in conservation, they are setting an example to the public that conservation is something that all New Zealanders should be conscious of. This is shown particularly well in the following quote by DOC3: "*we just don't have the capacity to do all the conservation, and if we were doing all the conservation…it would just be something that DOC does. People wouldn't have to worry about it themselves because 'DOC will do that', 'DOC will save the dolphins and we don't have to bother', and so that wouldn't necessarily lead to people behaving in a way which would conserve the environment*" (DOC3). This quote shows the importance of encouraging the public to change lifestyles in order for conservation to benefit. However, another point raised in the quote is that the Department of Conservation does not have the capacity to be the sole entity responsible for conservation.

This was discussed by Macdonald (2012), who noted that the DOC budget was cut by $54 million in 2009, despite a 2005 review finding that biodiversity decline was not being halted. Macdonald stated that DOC has had to rely more heavily on commercial partnerships for conservation funding, but also suggested that business partnerships might not be reliable in difficult economic times. While individual zoos do not have the same financial capacity to sponsor on such a large scale, their contributions to conservation could be considered more stable in that the zoos are not likely to withdraw their contributions. As discussed earlier, the modern zoo relies on showing the public that it exists for more than entertainment, even though the majority of visitors attend for entertainment purposes. Zoos do make monetary contributions towards conservation, but also contribute in a variety of ways. In addition to captive rearing young in the zoo to protect them from predation, captive breeding ensures that an 'insurance population' of the species is held separately from those in the wild. Staff are also able to contribute labour to in-situ conservation projects. Finally, and perhaps most importantly according to the practitioners interviewed, by advocating to the public for conservation zoos may help to change behaviour and lifestyles so that recovery programmes are needed less in the future.

The financial implications of conservation budget cuts were also apparent to the practitioners interviewed. According to WWR4, the New Zealand Conservation Trust at Willowbank is fundraising so that kiwi egg collection for captive rearing can continue after the available DOC funding was discontinued. This shows that the reliance of DOC on funding and co-

operation from outside sources has had to increase. Given that DOC is unable to be responsible for all conservation in New Zealand, the efforts and contributions of institutions such as zoos are arguably valuable.

5.10 Summary

The zoo and conservation practitioners shared the perspective that zoos in general are making an important contribution to conservation in New Zealand as a whole. Most of the practitioners, including those from the Department of Conservation, reiterated that they saw zoos' advocacy role as their most important contribution to conservation. These themes are reflected on in the following concluding chapter.

Chapter 6
Conclusions, Recommendations and Applications

This final chapter begins by revisiting the research aim and objectives, and summarises how they have been met over the course of the research. The next section discusses the contribution of New Zealand zoos to indigenous species conservation, and recommends a series of actions or interventions for zoos to improve their contributions to conservation. This is followed by a discussion of the effectiveness of the methods used in the research. Potential applications of the research and opportunities for further research are then suggested. The thesis concludes with a final discussion of zoos' contribution to conservation as part of New Zealand's wider conservation effort.

6.1 Research aim and objectives

The overall aim of the research was to evaluate the extent to which zoos in New Zealand contribute to the conservation of New Zealand indigenous species. In order to achieve this aim, five objectives were identified. These objectives allowed for an iterative process of research which progressed along a series of subsequent stages.

Objective 1: Evaluate the current state of knowledge on zoos and conservation.
An extensive review of the literature was conducted in order to evaluate the existing literature base, identify any gaps, and to inform the later stages of the research. Despite literature on conservation in zoos being readily available, connections between conservation and zoos in New Zealand were sparse. The literature also lacked cases where conservation in zoos has been evaluated. Various methods were suggested, although these were largely untested.

In particular, the literature identified that zoos perform three inter-woven roles of conservation, education, and entertainment. Using the information the literature identified as important, six criteria were chosen for the evaluation. These were: education; research; captive breeding; in-situ conservation; memberships, accreditation, and awards; and collaborations. Suggestions from the literature on how to evaluate conservation were also taken into consideration when forming the evaluation to make the evaluation as effective as possible and minimise subjectivity.

Objective 2: Research the history and status of zoos in New Zealand.
The general history of New Zealand zoos and the laws applying to zoos in New Zealand were researched. A database of the zoos was established, which included information such as the location and history of the individual zoos.

This objective contributed to the thesis by demonstrating how the role of New Zealand zoos has changed over time, as a whole and for zoos individually. The largest of these changes is that entertainment is no longer the primary role of a zoo. While entertainment is still the primary motivation of visitors to go to the zoo, zoos are also fulfilling roles in conservation and education.

Objective 3: Investigate criteria which could be used to evaluate New Zealand zoos' contribution to conservation of indigenous species.
Information was gathered for each of the zoos in New Zealand, based on the six criteria identified through the literature as a guide. This information was then entered into the database.

This stage was vital to the thesis in that the information was gathered which allowed zoos to be evaluated.

Objective 4: Evaluate whether or not (and to what extent) New Zealand zoos contribute to conservation of indigenous species.
The information in the database was then used to evaluate the contribution to conservation of indigenous species made by New Zealand zoos. For each of the six criteria, each zoo was given a rating between 0 and 4. This was assessed against guidelines developed for each criteria to minimise subjectivity. The evaluation shows the extent to which individual zoos are contributing to the conservation of indigenous species. There were zoos at both extremes; some zoos scored all fours or all zeroes. Other zoos either had scores consistent across a medium range, or showed strengths in particular criteria.

The evaluation showed that zoos in New Zealand are making a contribution to the conservation of indigenous species. The contribution is shown in a variety of ways depending on the criteria assessed – for example, a zoo could be contributing to conservation by funding conservation projects, allocating staff labour to conservation projects, releasing captive-bred individuals into the wild, or advocating for conservation. The evaluation showed the extent to which individual zoos are contributing to the conservation of indigenous species for each of the criteria. The overall contribution of a zoo to conservation of indigenous species was then determined based on its contribution to the criteria. For example, a zoo could be considered to

be making no contribution, a strong contribution, or a contribution in certain criteria. However, confounding factors (such as the budget of the zoos) was not part of the evaluation and therefore zoos may not be compared fairly to one another. Instead, the evaluation is useful in focusing on individual zoos to show the extent of their contribution and their strengths or weaknesses in terms of the six criteria used.

Objective 5: Examine how practitioners in New Zealand evaluate zoos' efforts to conserve indigenous species.

Three case studies were identified from the evaluation: Auckland Zoo (AZ), Orana Wildlife Park (OWP), and Willowbank Wildlife Reserve (WWR). Practitioners across a range of roles were interviewed at each of the zoos. In addition there were three conservation practitioners interviewed from the Department of Conservation (DOC).

This objective contributed to the thesis by adding further depth and context to the findings of the evaluation. Additionally, the interviews contributed their own results which would not have been revealed through the desk-based research alone. The most notable of these was that both the zoo and the conservation practitioners considered advocacy to be the most important role of zoos.

Following the stepwise process of the above five objectives has allowed the research aim to be met. The following section provides recommendations based on the research for zoos aiming to improve their contributions to conservation of indigenous species.

6.2. Recommendations

These following recommendations are based on the findings of the research, and in particular, on the perspectives of conservation and zoo practitioners. The recommendations are targeted in particular at zoos which are deemed to be making little or no contribution to conservation, although any New Zealand zoo wanting to increase its contribution could apply these recommendations.

It is suggested that where zoos have little or no contribution across all criteria, advocacy (as a component of education) should be the first area in which zoos focus conservation efforts. This is due to the high importance placed on advocacy by the practitioners interviewed. Several of the practitioners indicated that the most effective form of advocacy was staff speaking of their experiences to the public. This could take place either in a formal delivery such as a presentation, or (according to the practitioners) preferably in an informal one-on-one situation. Speaking to the public and conveying important conservation messages is a relatively simple way to begin advocating for conservation to visitors.

The contribution of staff labour to conservation projects is another recommended form of conservation. Any zoo can participate in some form of in-situ conservation, and the number of hours contributed can be tailored to the zoo's available resources. As this research has revealed, involvement in conservation projects outside the zoo has the benefit of collaboration with other organisations or individuals. The conservation practitioners interviewed considered collaboration in the zoo sector to be very positive. The zoo practitioners engaging in in-situ conservation projects added that it enriched their ability to advocate for conservation by relaying personal experiences and anecdotes of their field work.

In using in-situ experiences to advocate for conservation, zoo staff are making their advocacy messages more interesting or entertaining to visitors. This connects back to the need for conservation and education in zoos to be conducted in an entertaining manner for visitors. If zoos apply the above recommendations, they can make a contribution to education through advocacy and to conservation through in-situ involvement, and thereby fulfil zoos' three central roles of entertainment, education, and conservation.

6.3 Potential applications of the research

There is a variety of ways in which this research could be utilised. The literature review discussed the requirement of zoos in the UK to participate in a conservation activity in order to obtain their license. The evaluation method used in this research could be adapted for use as a similar tool by authorities when granting licenses or allowing zoos to hold indigenous species. The most important adaptation required would be to consider the relative size, visitor numbers, and budget of the zoo, and factor these into a comprehensive nation-wide evaluation of zoos.

The evaluation could also be adapted as an accreditation system similar to the star rating systems used in the tourism industry. The scale from zero to four could easily be adjusted to fit the five star rating system. Allowances would again need to be made to take into account the relative size and budget of the zoo.

Although the evaluation was designed using information already gathered and specific to New Zealand indigenous species, the same method could be used to determine zoos' contribution to exotic species conservation in New Zealand. It could also be used outside New Zealand to determine zoos' contribution to conservation, whether focused on the country's indigenous species or on conservation efforts overall.

Modifications could be made to the evaluation in order to change the weightings of the criteria. In other words, more importance could be placed on some criteria over others. Given

the importance placed on advocacy by practitioners, education would be the most suitable criteria to be given an added weighting over the other five criteria.

6.4 Reflecting on the Evaluative Methodology

One of the concerns relating to the research methods was that the information found for each zoo was reliant on what the zoo decided to put on its website. There was an assumption made that if a zoo was doing something related to conservation, then it would be mentioned on the website because it would reflect positively on the zoo. With this caveat in mind, this was the only feasible way to collect data on all the zoos in New Zealand within the timeframe. However, it is important to note that the information gathered from the websites of the three case study zoos closely matched the conservation efforts observed inside the zoo and the information from interviewees. One exception was Orana Park's use of Quick Response (QR) codes to access extra information on smartphones. This is a new initiative and was not mentioned on the website. It was common for a zoo's website to include information such as ticket prices, operating times, location and maps, news about the zoo, information for school teachers or groups, and information on the species including conservation information. The few zoos with less comprehensive websites tended to be small and either privately owned (such as a garden open to the public) or council-owned as part of a larger attraction, such as an aviary in a botanical garden.

Table 6.1 below is an adaptation of Table 4.8. It shows the score for each of the case study zoos from the evaluation, with a revised score after observation of the zoo and further information obtained from the case studies.

Table 6.1: Case study zoos' evaluation scores compared to revised evaluation scores after interviews.

Zoo	Stage	Education	Research	Captive Breeding	In-situ	Memberships	Collaborations
Auckland Zoo	Evaluation	4	4	4	4	4	4
	Case study	4	4	4	4	4	4
Orana Wildlife Park	Evaluation	2	3	4	1	3	0
	Case study	4	3	4	2	3	2
Willowbank Wildlife Reserve	Evaluation	4	4	4	3	0	1
	Case study	4	4	4	3	0	1

Table 6.1 shows that the scores for Auckland Zoo and Willowbank Wildlife Reserve remain the same after the case study interviews were completed. There are three differences in the scores for Orana Wildlife Park. Education was upgraded from 2 to 4 after OWP3 stated that group programmes are customisable, and explained the use of QR codes on interpretation. In-situ conservation changed from 1 to 2 because OWP2 stated that Orana Park staff help with releasing indigenous species back to the wild at nearby Peacock Springs. Finally, the collaborations criteria was upgraded from 0 to 2 because Orana Park staff collaborate strongly with Zoo and Aquarium Association (ZAA) member zoos in Australia. The collaborations are used to benefit indigenous species through advocacy, such as using research from the Australian contacts to improve interpretation and the delivery of advocacy messages.

Considering that the majority of the criteria for the zoos have the same scores before and after the information gained from case studies was taken into account, it is reasonable to judge that most of the conservation-related information for the majority of the zoos was present on the zoos' websites. Therefore, the method of using the zoos' website as an information source could be considered relatively accurate. The quotes obtained from practitioners also showed that the perspectives of DOC staff tended to reflect the perspectives of the zoo staff. This validated the perceptions of zoos' roles in conservation both in the present and in the future.

Another issue associated with evaluating conservation is subjectivity. The evaluation method used did have a degree of subjectivity; however, suggestions made by authors in the literature were used to minimise subjectivity. In particular, Usher (1986) suggested quantifying the evaluation with a system of steps or stages. In addition, a guide was created as to the level of conservation involvement which could be expected for each of the stages from 0 to 4. The creation of the guide was subjective, but its use in the evaluation for each criteria meant that the zoos were compared equally against the guide, and therefore were evaluated fairly in comparison to the other zoos.

As mentioned earlier in the thesis, the evaluation takes into consideration only the zoos' activities in relation to the criteria. Factors such as the size of the zoo, visitor numbers, or annual budget are not considered as part of the evaluation. This was highlighted by DEFRA (2010), who stated that conservation work is often constrained by funding, and that smaller zoos may find conservation activities more difficult. Without taking these figures into consideration it is unfair to compare zoos directly or rank them in terms of contribution to conservation. Instead, the evaluation is useful in identifying strengths or areas which could be improved in individual zoos, and in identifying zoos which make little or no contribution to

conservation across any of the criteria and are arguably most in need of focusing efforts on conservation.

While the desk-based stage of the research answered the research aim, the field-based component provided valuable information to add to the findings and give purpose to the research. The most notable of these was the emphasis that both zoo and conservation practitioners placed on zoos advocating for conservation. This was not evident in the desk-based research. Therefore, where zoos need to improve conservation efforts across all of the criteria used, the field-based research provides meaning in that advocacy was identified as the most important area to focus efforts on.

Similarly, situations have arisen over the course of the research where New Zealand zoos apparently differ to zoos discussed in the international literature. Some authors recommended that zoos collaborate with other zoos and with external institutions and organisations; however, the research showed that New Zealand zoos already do this. Another example is that of taking eggs from the wild and rearing them in captivity and then releasing the animals once they have grown. International literature is readily available on captive breeding in zoos, yet no mention of captive rearing in zoos was found in literature outside of New Zealand.

As stated earlier, the information gathered from interviews and from observation in the case study zoos matched the information gathered on the websites of the case study zoos. The fact that the field research supported the desk-based research validates the use of the websites as a research tool for the study.

6.5 Opportunities for further study

The results obtained from this research have helped to identify opportunities for further study. Due to constraints on time and budget, only a small number of case study zoos could be included in this research. More in-depth research on a greater number of zoos would be valuable in comparing practitioners' perspectives in regard to the evaluation of their zoo, and in comparing perspectives to those noted during this research. The information obtained could also be compared to the trends in perspectives identified in this research.

Chapter Three also discussed the benefits of interviewing a wider range of conservation practitioners to broaden the focus of the current research. Useful groups to include in such a study would be Forest and Bird, and species-focused recovery groups, such as the Kea Conservation Trust or the Kiwi Recovery Group.

The evaluation method adopted in this research is useful in showing the extent of individual zoos' contribution to conservation in various ways. However, it cannot be used to compare zoos to one another because it does not account for factors such as the budget of the zoo or its visitor numbers. Further research to take these considerations into account would allow the evaluation method to be adapted for use in licensing or accreditation.

An additional area where research would be beneficial is on the effectiveness of conservation advocacy methods used in zoos. Methods employed by the zoos have been mentioned earlier in the thesis, such as using anecdotal evidence to judge success or research from Australian zoos. However, research specific to New Zealand zoos would perhaps be useful in ensuring that zoos are able to advocate to the best of their abilities, given the importance placed on advocacy by practitioners.

6.6 Zoos' contribution to conservation

The evaluation has shown that as a whole, zoos in New Zealand are making an important contribution to the conservation of indigenous species. The interviews conducted with zoo and conservation practitioners have supported the findings of the evaluation, and revealed an importance placed on conservation advocacy in particular.

Zoo practitioners in the interviews viewed their conservation work as part of a larger picture of nature conservation in New Zealand. The conservation practitioners supported this by adding that New Zealand zoos do have an important role in conservation, particularly in advocating for conservation to the public. This reflects the zoo sector's unique situation of being able to provide education and interpretation to a relatively high turnover of visitors. DOC is not able to be responsible for all conservation effort in New Zealand, especially in light of recent budget cuts; and similarly, zoos have a limit as to the amount they can potentially contribute to conservation. These limitations reflect the importance placed on advocacy by zoo and conservation practitioners alike, but in order for conservation to occur on a large scale, the public of New Zealand need to understand the plight of indigenous species and learn about the multiple ways they can contribute to nature conservation. The results of this research suggest that New Zealand zoos are well positioned to take on these challenges and continue to be an important advocate for the conservation of indigenous species in New Zealand.

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Appendix A

Names of New Zealand indigenous species

As mentioned in Chapter One, New Zealand indigenous species often have more than one common name. The following table lists the indigenous species mentioned in this thesis alphabetically by their taxonomic name. Common Maori and English names are in the adjacent columns, with the common name used in the thesis shown in bold.

Taxonomic name	Maori common name	English common name
Anas chlorotis	Pateke	**Brown teal**
Anas nesiotis		**Campbell Island teal**
Anthornis melanura	Korimako, Makomako	**Bellbird**
Apteryx sp.	**Kiwi**	
Apteryx australis	Tokoeka	**Southern brown kiwi**, Common kiwi
Apteryx haastii	Roroa	**Great spotted kiwi**
Apteryx mantelli		**North Island brown kiwi**
Apteryx rowi	**Rowi**	Okarito brown kiwi
Aythya novaeseelandiae		**Scaup**, Black teal
Callaeas cinereus	**Kokako**	
Cyanoramphus sp.	**Kakariki**	Parakeet
Cyanoramphus unicolor		**Antipodes Island parakeet**
Deinacrida sp.		**Giant weta**
Eudyptula minor	Korora	**Little blue penguin**
Eudyptula minor albosignata		**White-flippered penguin**
Falco novaeseelandiae	Karearea	**New Zealand falcon**
Hemiphaga novaeseelandiae	**Kereru**	New Zealand pigeon, woodpigeon
Hoplodactylus sp.		**Gecko**
Hymenolaimus malacorhynchos	Whio	**Blue duck**
Leiopelma archeyi		**Archey's frog**

Taxonomic name	Maori common name	English common name
Mohoua ochrocephala	**Mohua**	Yellowhead
Naultinus sp.		**Gecko**
Nestor meridionalis	**Kaka**	
Nestor notabilis	**Kea**	
Notiomystis cincta	Hihi	**Stitchbird**
Orthodera novaezealandiae		**New Zealand mantis**
Porphyrio hochstetteri	**Takahe**	
Porphyrio porphyrio	**Pukeko**	Purple swamphen
Prosthemadera novaeseelandiae	**Tui**	
Rhipidura fuliginosa		**Fantail**
Scincidae (family)		**Skink**
Sphenodon guntheri *Sphenodon punctata*	**Tuatara**	
Sterna nereis davisae		**New Zealand fairy tern**
Strigops habroptila	**Kakapo**	
Zosterops lateralis	Tauhou	**Silvereye**, waxeye

Appendix B

List of Acronyms

ARAZPA – Australasian Regional Association of Zoological Parks and Aquaria (now known as ZAA)
AZ – Auckland Zoo
AZA – Association of Zoos and Aquariums (regional association primarily in the US)
BNZ – Bank of New Zealand
CBD – Convention on Biological Diversity
CMaG – Conservation Management Group
DOC – Department of Conservation
ESOL – English for Speakers of Other Languages
ISIS – International Species Information System
ISO – International Organisation for Standardisation
IUCN – International Union for Conservation of Nature
NIWA – National Institute for Water and Atmospheric Research
NZCCM – New Zealand Centre for Conservation Medicine
NZCT – New Zealand Conservation Trust
ONE – Operation Nest Egg
OWP – Orana Wildlife Park
QR – Quick Response
WAZA – World Association of Zoos and Aquariums
WWR – Willowbank Wildlife Reserve
ZAA – Zoo and Aquarium Association (regional Australasian association)

Appendix C

Examples of Interview Guides

Zoo practitioner

- Is there a conservation policy or strategy for the zoo? How often do you use or apply it in your job?
- Does the zoo have a relationship with conservation agencies (eg. Department of Conservation, Forest and Bird)? What is their role in the management of the zoo?

Theme: Conservation activities currently being undertaken by the zoo.

- Are there any conservation activities currently in place at the zoo?
- What is the history of these conservation activities? How were they developed? Why were these conservation activities decided on?
- Who at the zoo is involved with the conservation activities (which positions do they hold)?

Theme: Practitioner's perception of how effective the conservation activities are and their perception of what constitutes success.

- Do you think that these conservation activities are successful within the zoo, and why?
- Should zoos measure the success of a conservation activity? How do you measure 'success'?
- How do the zoo's conservation activities for indigenous species contribute to conservation in New Zealand?

Theme: Ways in which the zoo could improve its conservation activities.

- What do you think the zoo could do to improve the conservation activities it has in place?
- Does the zoo have a strategy or plan for conserving indigenous species in the future?

Theme: Role of New Zealand zoos in conservation of indigenous species.

- How does the zoo contribute to conservation as a whole in New Zealand?
- How do zoos as a whole contribute to conservation in New Zealand?
- What do you think zoos' roles in New Zealand conservation will be in the future?

Conservation practitioner:

Theme: Conservation activites currently taking place for indigenous species in New Zealand zoos (in general) and potential improvements that could be made.

- What conservation activities for New Zealand indigenous species do you know of that have or are are currently taking place in New Zealand zoos?
- How are breeding programmes managed across the country? Who are the key organisations and agencies involved with conservation in zoos, and what are their responsibilities?
- How does the Department of Conservation decide which species to focus on?
- How does the Department choose which zoos to allow to have indigenous species?
- Do you think that there could improvements made to existing conservation activities in New Zealand zoos for indigenous species? If so what could they be?
- If there were to be new conservation activities introduced, what do you think New Zealand zoos should introduce for indigenous species?

Theme: Success of conservation activities for indigenous species in New Zealand zoos, and what constitutes this success or failure.

- Do you think 'success in conservation' should be measured? If so, how do you measure 'success' in conservation, and does this also apply to zoos?
- Do you believe that the conservation activities for indigenous species in New Zealand zoos have been and are successful, - if so why? Can you provide me with some examples?

Theme: Zoos' roles in New Zealand conservation.

- How do zoos in New Zealand contribute to indigenous species conservation?
- Should zoos have a role in conservation, in New Zealand as a whole?
- What role do you think zoos will play in the future?

Appendix D

Database of New Zealand Zoos

Name of zoo	Education	Research	Captive breeding	Insitu programmes	Collaborations	Association memberships/ accreditation/ awards
Auckland Zoo	Junior keeper for a day programme for ages 6-18, Discovery & Learning Centre with qualified specialist educators, learning experiences for early childhood-year 13. Tips offered on the website for changes to make to everyday life to protect the coast. Work experience available for Yr 12/13 students.	Research taking place in the NZ Centre for Conservation Medicine. Projects include ecosystem health maps of sanctuary islands, & health/diseases of kakariki on Tiritiri Matangi.	Breed & release programmes for Northern tuatara, North Island brown kiwi, blue duck, North Island kokako, brown teal, North Island kaka. Bred Archey's frog & shorttailed bat. NZ Fauna Conservation Centre. Breed & release programmes for Northern tuatara, North Island brown kiwi, blue duck, North Island kokako, brown teal, North Island kaka.	Urban ark pest control on zoo and neighbouring properties. Supports/funds: Ark in the Park (sponsors 30ha of predator control, provides staff and released NI robin, stitchbird, & whitehead); Kea Conservation Trust; Maui Dolphin Recovery Group; Wingspan Birds of Prey Trust; NZ Sea Lion Trust; Operation Nest Egg; Headstart Tuatara breed-for-release programme. Also has vet team on site (NZ Centre for Conservation Medicine) assisting with other native species eg Kakapo Recovery Programme.	Mentions DOC, Victoria University, Auckland Regional Council, Forest & Bird, Canterbury University, and the Zoological Society of Auckland. Has a partnership with local iwi (Ngati Whatua o Orakei).	ZAA, WAZA, ISIS membership. 2005 Conservation Achievement Award in Partnerships & Community Involvement. 2005 ARAZPA in situ Conservation Award. Gold EnviroMark accreditation (2006) ISO 14001 accredited
Brooklands Zoo	Educational keeper talks/tours.					ZAA, ISIS

Dunedin Botanic Garden			Participates in South Island kaka and kea two Captive Management Programmes. Breeds native birds for release for the Otago Natural History Trust.	Breeds native birds for Otago Natural History Trust to release into eco-sanctuary.	Dunedin Botanic Garden	
Franklin Zoo & Wildlife Park	Works with schools to tailor lessons/create support teaching materials, junior keeper programme, practical work placements for students, educational keeper talks.				Works with Australasian Species Management Program zoos to hold animals and assist breeding programmes.	
Hamilton Zoological Gardens	Early childhood-secondary learning experiences with NZ trained, registered teachers. Keeper talks focusing on native birds 4 days a week, and the kea 2 days a week.		Breeds tuatara and has bred brown teal for over 20 years. Handraising kokako. All tuatara except one are kept in a group off display. Released over 150 brown teal. Tuatara eggs sent to Victoria University to hatch, and then safe islands after 5 years.		Tuatara eggs sent to Victoria University.	ZAA, ISIS
International Antarctic Centre	Qualified teachers on site, programmes can be customised for the students. Primary-tertiary, programmes available for community/ESOL groups.			Sponsors the pupils of Le Bons Bay School, who started a penguin conservation programme 2 years ago.		ZAA
Katikati Bird Gardens						

Kiwi Birdlife Park	Two live shows daily with zoologists.	Participates in research by providing samples/feathers/individuals.	Brown teal, redcrowned/yellowcrowned kakariki, kiwi, scaup, green gecko. Incubation lab for eggs. Six brown teal released by DOC in 2011. One brown kiwi in 2010.	Previously involved with Operation Nest Egg. Staff have worked voluntarily with DOC. Supported 3 staff going to Codfish Island with DOC for two weeks to monitor kakapo.	Works with DOC to release captivebred birds into the wild.	ZAA Gibbs Wildlife Conservancy Excellence Award for the Most Innovative Wildlife Display for the Campbell Island teal enclosure.
Kiwi North	Programmes for years 113. Employs a "LEOTC (Learning Experiences outside the Classroom) educator".				Department of Conservation, Matakohe/ Limestone Island and “other conservation groups".	ZAA
Maple Glen						
National Aquarium of New Zealand	Specialised topics available for preschool-tertiary. Special education dates planned throughout the year.	Allows NIWA and university scientists to conduct research on site.	None mentioned for tuatara, kiwi, geckos, or skinks.	Lizards in your Garden project 2010-2011, Westshore Kiwi project 2009. Involved with a tuatara recovery programme along with DOC, Victoria, and Otago universities.	DOC, Hawkes Bay Regional Council, National Institute of Water and Atmospheric Research, Ngati Kahungunu	Qualmark Enviro Award Silver
Natureland Zoo	Onsite, registered teachers. Customisable curriculum for years 1-13.					ZAA, WAZA

Nga Manu Nature Reserve	Group talks available, and posters/study sheets/powerpoints available free to teachers.	Sponsors two research scholarships with Massey and Victoria universities. Variety of research projects collaborated on on-site.	Brown teal		Has participated in research with Massey, Victoria, and Canterbury universities, and Landcare Research.	ZAA
Orana Wildlife Park	Zoo School (Learning Outside The Classroom) registered teachers on site. Guided tours. Keeper presentations at feeds.	Captive research on mohua for DOC's in-situ efforts.	Breed for release programmes for blue duck, brown teal, and NI brown kiwi. Previously bred tuatara. Kiwi breeding unit. Blue duck and brown teal are "regularly released".	Waste reduction/composting programmes in place.		ZAA, WAZA, ISIS
Otorohanga Kiwi House	Full time educator, programmes available to be customised for school visits.		Kiwi, NZ falcon, tuatara, variable oystercatcher. Incubation facilities. Kiwi release programme at Mapara Kokako Reserve. 2 NI brown kiwi released into private reserve. Two kiwi released in Tarata Marae reserve.			ZAA
Owlcatraz			Morepork			
Paradise Valley Springs Wildlife Park				Enviro-friendly practices.		ZAA Qualmark Enviro Award Gold

Pukaha Mt Bruce National Wildlife Centre	Guided tours for the public.		Kiwi, kokako, uncontrolled kaka breeding, takahe, stitchbird. Incubation and brooding rooms. Kokako released on and off site, kaka released on site. Stitchbirds released off site.	Pest control and forest regeneration programmes on site, contracted by DOC. Environmentally friendly practices, including waste management/recycling programmes, energy efficiency, and collecting most of the water from the visitor centre roof.	Collaborate with DOC for species management, forest regeneration, and pest control.	ZAA
Rainbow Springs Kiwi Wildlife Park	Education section of website focused on teaching about NZ's environment, plants, animals, and introduced animals.	Research and monitoring involved with Operation Nest Egg.	Kiwi Nursery and hatchery with incubation facilities, and outdoor enclosures. Since 1995, have hatched, raised, and released 492 kiwis into the wild. 700th chick hatched in March 2009.	Involved in BNZ Operation Nest Egg since 1995, including research/monitoring work and in field support.		ZAA Qualmark Enviro Award Gold
Reikorangi Pottery and Animal Park						
Southland Museum	Learning Experiences Outside the Classroom provider, special programmes for years 13, 48, 410, and 913. Public tours available.		Tuatara			
Staglands Wildlife Reserve	Worksheet for primary school students. Talks about native birds possible.		Blue duck, brown teal, NZ falcon, kea, NI kaka.		Works with DOC for captive breeding.	
Te Anau Wildlife Centre						

Te Puia Kiwi House	Group visit options and education programmes include the kiwi house.		Kiwi. Breeding pairs kept quarantined and off display.			Qualmark Enviro Award Gold
The National Kiwi Centre	Education tours available.					
The Parrot Place						
Ti Point Reptile Park	Website has detailed information on each species. Educational tours available, and info on website for worksheets.					ZAA
Wellington Zoo	Preschool-tertiary education possible. Worksheets and resources available for visits, along with follow-up/extension possibilities.	Veterinary research in the hospital (the 'Nest') area of the zoo, including vaccinations for kakapo, respiratory research on kea, and assessments of seals and sea lions. Working with Wellington Greater Regional Council on developing kaka-proof possum bait stations.	Brown kiwi (52 chicks raised between 1981-1999). Kaka, tuatara 'The Nest' animal hospital and centre for native wildlife. In 2007, released 55 tuatara onto an island in Cook Strait. Released 5 kaka into mainland islands in 2007 and 3 in 2008.	Housing grand and Otago skinks as insurance populations for DOC, and working with DOC in-situ to monitor skinks. Wellington Bush Builders community education project and monitoring. Places for Penguins project with Forest and Bird. Staff volunteered with DOC and other zoos around the world. Sustainable operation and building practices. Planted native plants around zoo grounds.	DOC, Victoria University, Te Ati Awa, Forest and Bird	ZAA, ISIS Qualmark Enviro Award Gold Winner of Sustainable Business awards.
West Coast Wildlife Centre	On-site educators, cater for preschool-tertiary. Also offer community education programmes.		Incubation and captive rearing programme for both kiwi species. Incubation facilities. 16 Rowi chicks released after 2010/2011 breeding season.	BNZ Operation Nest Egg.	DOC	

Willowbank Wildlife Reserve	Educational programmes on site run by NZCT, resources/games on website, tuatara school visits, junior keeper programme. Breeding and Kiwi tours available.	Has a Wildlife Hospital, Education and Research Centre on site.	Kiwi breeding facility, also used for hatching and rearing eggs/chicks from wild (Operation Nest Egg), buff weka, tuatara. 2ha outdoor predator-proofed breeding area for kiwi. Nocturnal house is for juvenile kiwi bred at Willowbank. At end of 2009/10 season 26 Southern brown, 45 Rowi, 1 North Island Brown, and 16 Great spotted kiwi chicks were reared and released.	Operation Nest Egg taking eggs from wild, hatching and rearing in captivity, then releasing back to wild. Wildlife hospital.	DOC, NZCT	
Wingspan Birds of Prey	Adaptable group tours available. Informative game on website.	Research at Kaingaroa Forest mentioned.	Captive breeding, and raising orphaned chicks from the wild. Rearing facilities.	Collects reports of falcon sightings to put into a national database coordinated with DOC and the Raptor Association of NZ.	DOC, Raptor Association of New Zealand.	Won DOC's 'Contribution to Conservation by a Group' award in 2004.
Zealandia	Early childhood-secondary, conservation-related themes adaptable for specific ages. Resource materials available and educators on site. Free ranger tours and talks for the public.	In addition to research conducted by the Trust, the sanctuary allows professional/university researchers to conduct research on site - 17 in the 2010/2011 year.	Maud Island frogs have bred in enclosures. Tuatara bred in wild, and eggs were taken to Victoria University for hatching. Report mentions a 'gecko nursery'. Enclosures to protect juvenile tuatara. Nestboxes around the sanctuary for birds. Released 15 species of birds into the sanctuary .	Wellington Regional Lizard Network, Karori Halo Project, Wellington Green Forum, Wellington Region Biodiversity Monitoring Group, Sanctuaries of NZ.	Victoria University, DOC, Forest and Bird.	2010/2011 Virgin Holidays Responsible Tourism: Best for Conservation of Wildlife and Habitats.

Appendix E

Evaluations of criteria with guidelines

Education	Action taken (0=none, 4=highest)				
	0	1	2	3	4
Auckland Zoo					✓
Brooklands Zoo		✓			
Dunedin Botanic Garden	✓				
Franklin Zoo & Wildlife Park					✓
Hamilton Zoological Gardens				✓	
International Antarctic Centre				✓	
Katikati Bird Gardens	✓				
Kiwi Birdlife Park		✓			
Kiwi North			✓		
Maple Glen	✓				
National Aquarium of New Zealand			✓		
Natureland Zoo				✓	
Nga Manu Nature Reserve				✓	
Orana Wildlife Park				✓	
Otorohanga Kiwi House				✓	
Owlcatraz	✓				
Paradise Valley Springs Wildlife Park	✓				
Pukaha Mt Bruce National Wildlife Centre		✓			
Rainbow Springs Kiwi Wildlife Park				✓	
Reikorangi Pottery and Animal Park	✓				
Southland Museum			✓		
Staglands		✓			
Te Anau Wildlife Centre	✓				
Te Puia Kiwi House		✓			
The National Kiwi Centre		✓			
The Parrot Place	✓				
Ti Point Reptile Park				✓	
Wellington Zoo					✓
West Coast Wildlife Centre			✓		
Willowbank Wildlife Reserve					✓
Wingspan Birds of Prey		✓			
Zealandia					✓

Guidelines:
1: Only school/public tours or keeper talks
2: Registered teacher, specific programmes
3. Customisable programmes, resources
4. Combinations and extensions of the above, additional education

Research	Action taken (0=none, 4=highest)				
	0	1	2	3	4
Auckland Zoo					✓
Brooklands Zoo	✓				
Dunedin Botanic Garden	✓				
Franklin Zoo & Wildlife Park	✓				
Hamilton Zoological Gardens	✓				
International Antarctic Centre	✓				
Katikati Bird Gardens	✓				
Kiwi Birdlife Park			✓		
Kiwi North	✓				
Maple Glen	✓				
National Aquarium of New Zealand		✓			
Natureland Zoo	✓				
Nga Manu Nature Reserve				✓	
Orana Wildlife Park				✓	
Otorohanga Kiwi House	✓				
Owlcatraz	✓				
Paradise Valley Springs Wildlife Park	✓				
Pukaha Mt Bruce National Wildlife Centre	✓				
Rainbow Springs Kiwi Wildlife Park				✓	
Reikorangi Pottery and Animal Park	✓				
Southland Museum	✓				
Staglands	✓				
Te Anau Wildlife Centre	✓				
Te Puia Kiwi Hosue	✓				
The National Kiwi Centre		✓			
The Parrot Place	✓				
Ti Point Reptile Park	✓				
Wellington Zoo					✓
West Coast Wildlife Centre	✓				
Willowbank Wildlife Reserve					✓
Wingspan Birds of Prey			✓		
Zealandia				✓	

Guidelines:
1: Allows research to be conducted
2. Collaborations/research funding
3: Conducting own research
4: Specialist research centre

Captive Breeding	Action taken (0=none, 4=highest)				
	0	1	2	3	4
Auckland Zoo					✓
Brooklands Zoo	✓				
Dunedin Botanic Garden				✓	
Franklin Zoo & Wildlife Park	✓				
Hamilton Zoological Gardens					✓
International Antarctic Centre	✓				
Katikati Bird Gardens	✓				
Kiwi Birdlife Park					✓
Kiwi North	✓				
Maple Glen	✓				
National Aquarium of New Zealand	✓				
Natureland Zoo	✓				
Nga Manu Nature Reserve		✓			
Orana Wildlife Park					✓
Otorohanga Kiwi House					✓
Owlcatraz		✓			
Paradise Valley Springs Wildlife Park	✓				
Pukaha Mt Bruce National Wildlife Centre					✓
Rainbow Springs Kiwi Wildlife Park					✓
Reikorangi Pottery and Animal Park	✓				
Southland Museum		✓			
Staglands			✓		
Te Anau Wildlife Centre	✓				
Te Puia Kiwi House			✓		
The National Kiwi Centre	✓				
The Parrot Place	✓				
Ti Point Reptile Park	✓				
Wellington Zoo					✓
West Coast Wildlife Centre					✓
Willowbank Wildlife Reserve					✓
Wingspan Birds of Prey			✓		
Zealandia				✓	

Guidelines:
1: Captive breeding of one species
2: Captive breeding of multiple species
3: Specialist facilities or released individuals
4: All of the above or released for multiple years

Outreach/in situ programmes	Action taken (0=none, 4=highest)				
	0	1	2	3	4
Auckland Zoo					✓
Brooklands Zoo	✓				
Dunedin Botanic Garden	✓				
Franklin Zoo & Wildlife Park	✓				
Hamilton Zoological Gardens	✓				
International Antarctic Centre		✓			
Katikati Bird Gardens	✓				
Kiwi Birdlife Park			✓		
Kiwi North	✓				
Maple Glen	✓				
National Aquarium of New Zealand				✓	
Natureland Zoo	✓				
Nga Manu Nature Reserve	✓				
Orana Wildlife Park		✓			
Otorohanga Kiwi House	✓				
Owlcatraz	✓				
Paradise Valley Springs Wildlife Park		✓			
Pukaha Mt Bruce National Wildlife Centre			✓		
Rainbow Springs Kiwi Wildlife Park			✓		
Reikorangi Pottery and Animal Park	✓				
Southland Museum	✓				
Staglands	✓				
Te Anau Wildlife Centre	✓				
Te Puia Kiwi House	✓				
The National Kiwi Centre	✓				
The Parrot Place	✓				
Ti Point Reptile Park	✓				
Wellington Zoo					✓
West Coast Wildlife Centre			✓		
Willowbank Wildlife Reserve				✓	
Wingspan Birds of Prey			✓		
Zealandia					✓

General Guidelines
1: Sponsoring one project, enviro-friendly practices
2: Involvement with one project
3: Involvement with multiple projects
4: Heavy involvement with multiple projects

Association memberships, accreditation, and awards	Action taken (0=none, 4=highest)				
	0	1	2	3	4
Auckland Zoo					✓
Brooklands Zoo				✓	
Dunedin Botanic Garden				✓	
Franklin Zoo & Wildlife Park	✓				
Hamilton Zoological Gardens				✓	
International Antarctic Centre			✓		
Katikati Bird Gardens	✓				
Kiwi Birdlife Park				✓	
Kiwi North			✓		
Maple Glen	✓				
National Aquarium of New Zealand				✓	
Natureland Zoo				✓	
Nga Manu Nature Reserve			✓		
Orana Wildlife Park				✓	
Otorohanga Kiwi House			✓		
Owlcatraz	✓				
Paradise Valley Springs Wildlife Park					✓
Pukaha Mt Bruce National Wildlife Centre			✓		
Rainbow Springs Kiwi Wildlife Park					✓
Reikorangi Pottery and Animal Park	✓				
Southland Museum	✓				
Staglands	✓				
Te Anau Wildlife Centre	✓				
Te Puia Kiwi House				✓	
The National Kiwi Centre	✓				
The Parrot Place	✓				
Ti Point Reptile Park			✓		
Wellington Zoo					✓
West Coast Wildlife Centre	✓				
Willowbank Wildlife Reserve	✓				
Wingspan Birds of Prey		✓			
Zealandia		✓			

Guidelines:
1: Awards only
2: Membership of an association
3: Multiple memberships/awards, or accreditation only
4: Any type of accreditation, and awards/memberships

Collaborations	Action taken (0=none, 4=highest)				
	0	1	2	3	4
Auckland Zoo					✓
Brooklands Zoo	✓				
Dunedin Botanic Garden			✓		
Franklin Zoo & Wildlife Park	✓				
Hamilton Zoological Gardens			✓		
International Antarctic Centre	✓				
Katikati Bird Gardens	✓				
Kiwi Birdlife Park		✓			
Kiwi North					✓
Maple Glen	✓				
National Aquarium of New Zealand					✓
Natureland Zoo	✓				
Nga Manu Nature Reserve				✓	
Orana Wildlife Park	✓				
Otorohanga Kiwi House	✓				
Owlcatraz	✓				
Paradise Valley Springs Wildlife Park	✓				
Pukaha Mt Bruce National Wildlife Centre		✓			
Rainbow Springs Kiwi Wildlife Park	✓				
Reikorangi Pottery and Animal Park	✓				
Southland Museum	✓				
Staglands		✓			
Te Anau Wildlife Centre		✓			
Te Puia Kiwi House	✓				
The National Kiwi Centre			✓		
The Parrot Place	✓				
Ti Point Reptile Park	✓				
Wellington Zoo					✓
West Coast Wildlife Centre		✓			
Willowbank Wildlife Reserve		✓			
Wingspan Birds of Prey			✓		
Zealandia					✓

General Guidelines
1: Mentions DoC
2: Mentions one
3: Mentions one and DoC, or multiples
4: Mentions DoC and multiples